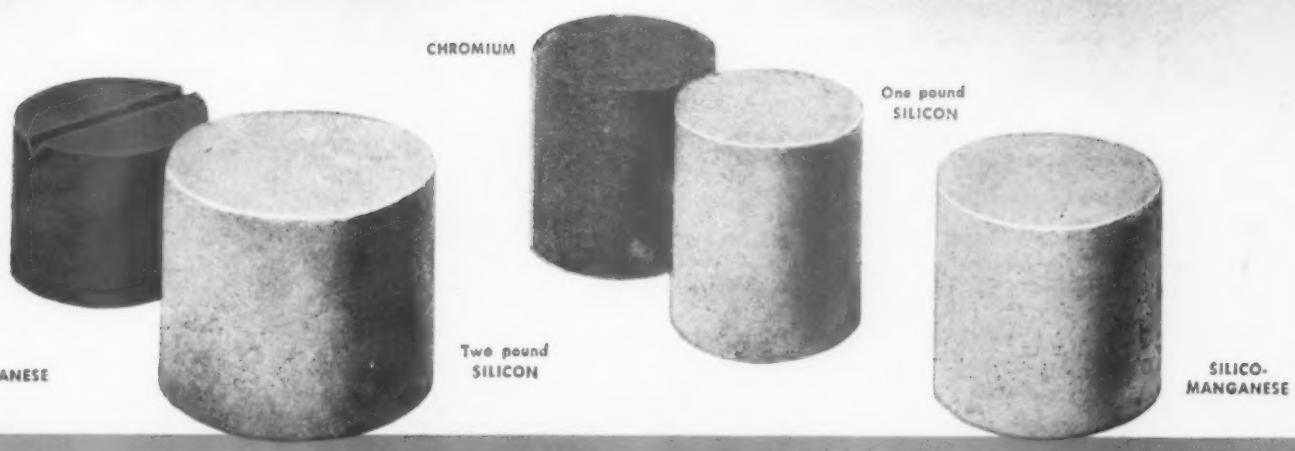
December, 1950

THE FOUNDRY

wherever metals are cast...

OHIO FERRO-ALLOY Briquets IN THE IRON FOUNDRY

FOR ECONOMY • ACCURACY • CONVENIENCE



Ohio Ferro-Alloys Corporation
Canton, Ohio

PHILO DEPENDABILITY QUALITY SERVICE
RAINIER DEPENDABILITY QUALITY SERVICE

how PURITE assures Cleaner Iron Better Castings through

CONVENIENT, ECONOMICAL, EFFECTIVE FLUXING and DESULPHURIZING

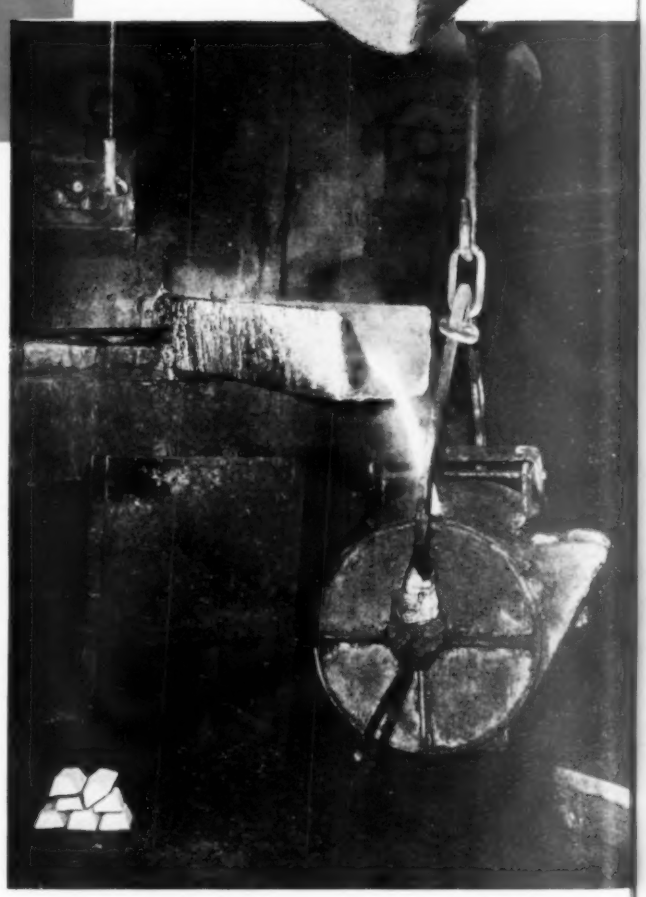
PURITE 100% FUSED SODA ASH

The Scientific Flux for Better Melting and Cleaner Iron

Purite is a country-wide foundry favorite. This broad acceptance is based on proven performance in producing better castings. Here are the reasons why Purite is first choice in foundry after leading foundry:

1. **Purite gives 100% fluxing action in the cupola—100% desulphurizing action in the ladle.**
2. **Purite gets to the iron faster—no quicker desulphurizer made.**
3. **Purite is time-tested and proven for unsurpassed desulphurizing uniformity.**
4. **Purite comes in 2 lb. pigs—no weighing or measuring required.**
5. **Purite is 100% pure fused soda ash—you do not pay for inert materials.**
6. **Purite does not crumble—no waste—no dust.**
7. **Purite can be shipped in bulk carloads at substantial savings over bag shipments—is easily stored without deterioration.**

For nearly 30 years there's been no substitute for this successful product. Confirm Purite's many advantages by an actual trial in your own cupolas and ladles. If you need further information, please write today to: Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.



Tapping a modern cupola at the foundry of Mack Trucks, Inc., at New Brunswick, N. J.

Mathieson CHEMICALS

Purite is sold by all leading foundry supply houses in the United States and Canada.

SERVING INDUSTRY, AGRICULTURE AND PUBLIC HEALTH

TECHNOLOGY DEPT.

How Bronzes Containing NICKEL Provide Improved Properties

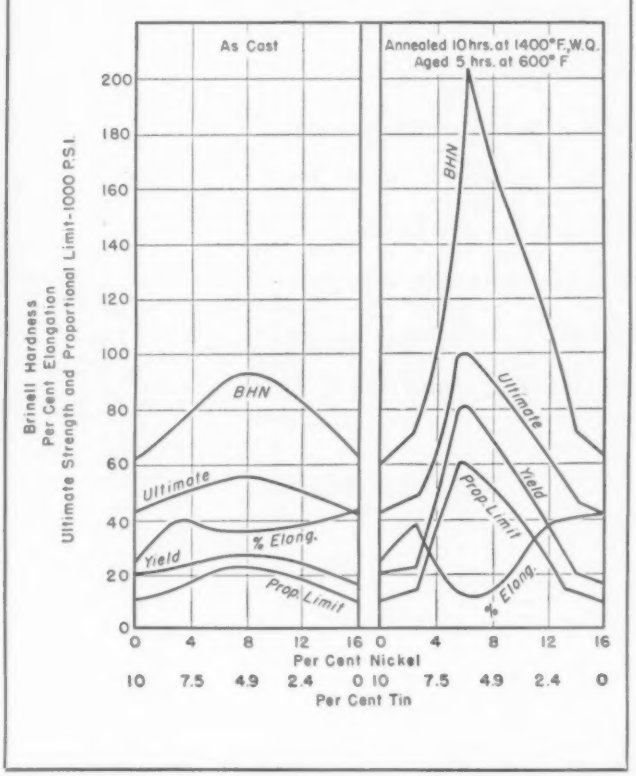
PUBLIC LIBRARY
DEC 5 1950
DETROIT

Copper-base alloys provide outstanding advantages to users and producers, alike. These are enhanced when moderate amounts of nickel are utilized.

HOW NICKEL IMPROVES CAST BRONZE

For instance . . . small percentages of nickel refine the grain, strengthen the alloy, and improve its resistance to wear and corrosion. By increasing fluidity in the casting mixture, nickel affords a wider casting range, and thus helps to minimize misruns and to improve density and pressure-tightness.

Effect of Nickel on the Mechanical Properties of Sand Cast and Heat Treated Tin-Bronze Alloys.



RESPONSE TO HEAT TREATMENT

In certain cases, a moderate nickel content makes possible the response to heat treatment which increases the tensile and compressive strength, being particularly effective in raising elastic properties.

Certain cast nickel bronzes are very responsive to heat treatment. The hardness of an alloy containing 7.5 per cent nickel and 8 per cent tin, for example, can be increased from about 75 to 277 BHN by appropriate heat treatment.

TYPICAL APPLICATIONS

Typical applications of nickel bronzes include worm wheels, gears, liners, bushings, bearing backs, valve guides and seats, pumps, valves, fittings, plumbing goods, miscellaneous structural and engineering uses.

COUNSEL AND DATA

Nickel alloyed bronzes offer significant advantages. Whatever your industry, we solicit the opportunity to help you with counsel and data pertaining to these economical alloys.

EMBLEM OF INCO SERVICE TRADE MARK

Because of unusually heavy industrial and defense demand, rationing of nickel has been in force since July 1st. However, we believe that dissemination of technical data and service experience can help to promote the intelligent utilization of critical materials, so essential in these times. We shall, therefore, continue to issue information on new developments and user experience with nickel-containing materials.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

May this Christmas be the best ever!

* * * * * * * * * * *

I have always thought of Christmas time as a good time; a kind, forgiving, charitable, pleasant time; the only time I know of, in the long calendar of the year, when men and women seem by one consent to open their shut-up hearts freely . . .

And therefore, though it has never put a scrap of gold or silver in my pocket, I believe that it has done me good, and will do me good; and I say, God bless it!

—Charles Dickens

* * * * * * * * * * *

The **FEDERAL FOUNDRY SUPPLY** *Company*

* * CLEVELAND 5, OHIO * *

DECEMBER, 1950

THE FOUNDRY

VOLUME 78—NUMBER 12

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Published monthly by

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Member: Audit Bureau of Circulations and National Publishers Association. Copyright 1950 by THE PENTON PUBLISHING CO.

Entered as second class matter at postoffice at Cleveland, Ohio, under act of March 3, 1879.

THE FOUNDRY is indexed regularly by Engineering Index Inc. 29 West 39th St., New York 18.

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A Twenty-five Year Record of...

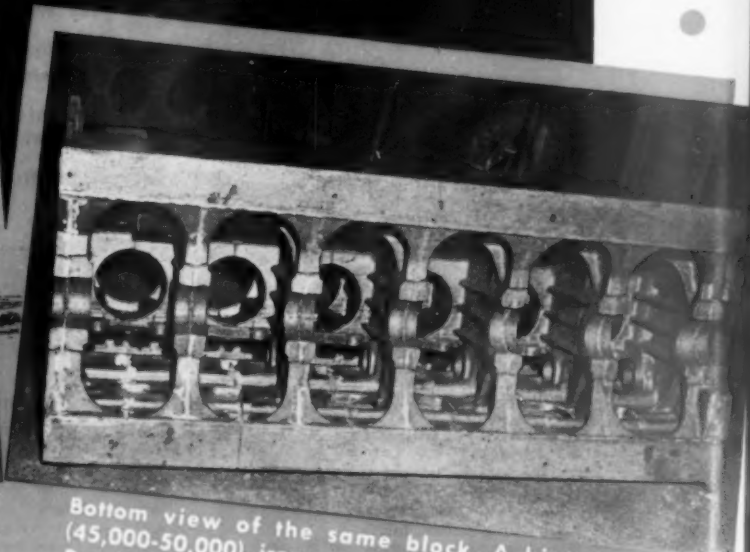
CLEANER CASTINGS...EASIER SHAKE O

"We use LINOIL all the way through our foundry, and have done so continually for the past twenty-five years," says Adam Pietz, Vice President and Foundry Manager of the Iowa Steel and Iron Works, who has been with Iowa Steel for thirty-eight years. "Our scrap report seldom shows a casting scrapped for core failure."

In a Diesel engine block casting, the interior (the cored surface) is subject to extremely close and accurate machining. This cored surface must therefore be smooth, and LINOIL'S low gas ratio helps smoothness by preventing scabs and blows. It must be clean . . . LINOIL'S high baked strength resists washing and burn-ins; yet LINOIL'S quick collapsibility keeps shakeout time to a minimum.

Experience at Iowa Steel shows that LINOIL'S uniform performance helps maintain high quality on this job as it has on thousands of other jobs during the last quarter-century.

A six cylinder Diesel engine block cast at Iowa Steel for Buda Mfg. Co. The block weighs 1980 pounds . . . 2400 pounds of metal poured.



Bottom view of the same block. A high tensile (45,000-50,000) iron containing 55% steel is used. Pouring temperature is 2500°

OUT...with LINOIL

at IOWA STEEL and IRON WORKS

CEDAR RAPIDS, IOWA

Inspecting 1400 pounds of LINOIL cores in the drag of a Diesel engine block mold.

LINOIL
THE LOGICAL OIL

Archer-Daniels-Midland Company

(THE WERNER G. SMITH COMPANY DIV.)

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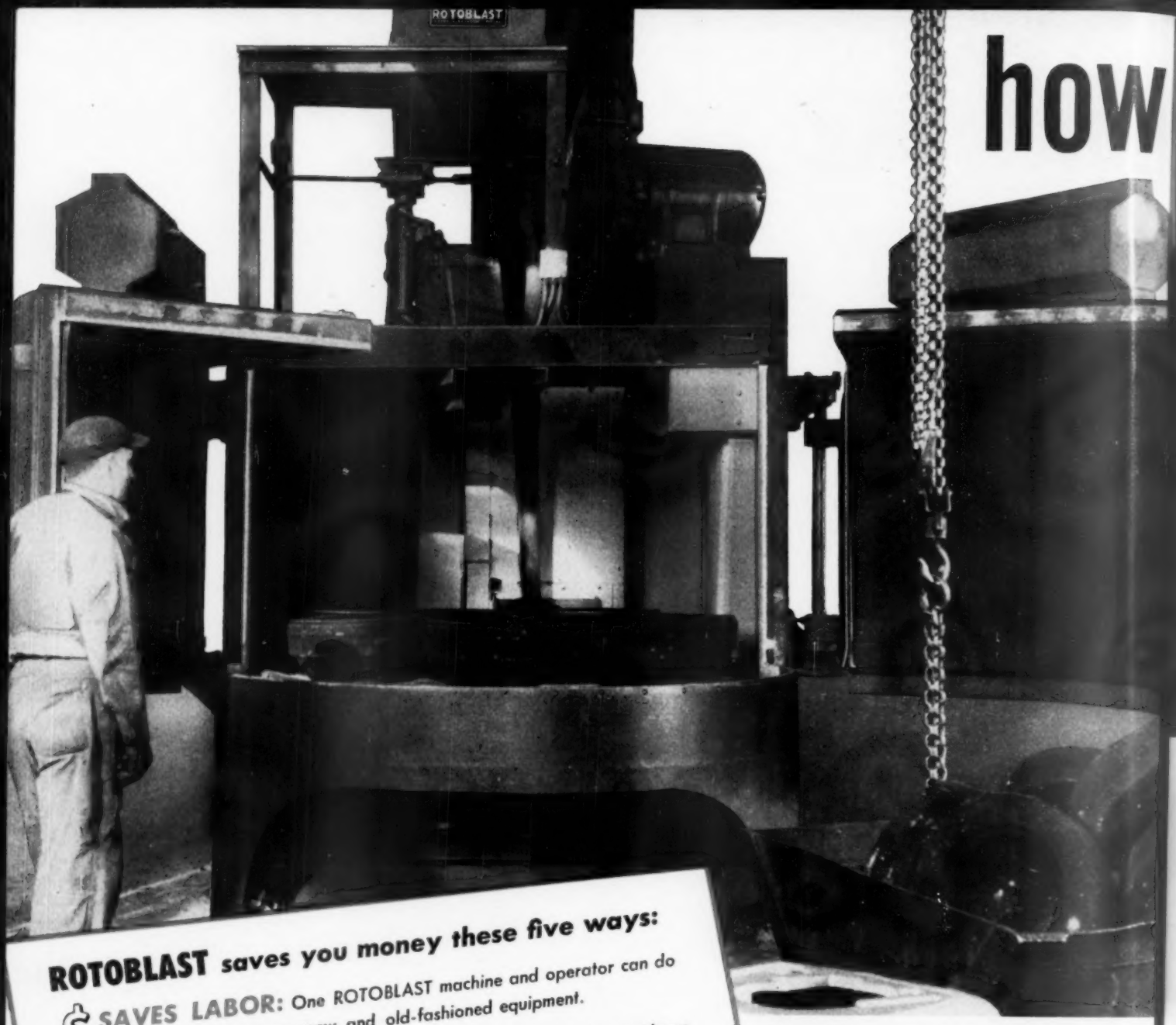


how

ROTOBLAST saves you money these five ways:

SAVES LABOR: One ROTOBLAST machine and operator can do as much as a two-man crew and old-fashioned equipment.

SAVES SPACE: In many cases, one ROTOBLAST machine replaces five or more old-fashioned machines, requires less space.

SAVES TIME: Cases on record prove ROTOBLAST can cut cleaning time up to 95.8% compared to old-style methods.

SAVES POWER: Modern ROTOBLAST uses but 15-20 h.p. compared to old-fashioned equipment requiring 120 h.p. for same job.

SAVES TOOLS: On work cleaned with ROTOBLAST, cutting tools last up to 2/3 longer because no scale is left to dull edges.

● ***ROTOBLAST TABLE-ROOM*** *(above) cleans the entire output of an airblast room in 40% less time and practically eliminates breakage of delicate castings.*

All these savings mean INCREASED PROFITS for you!

Look to Pangborn for the Latest Developments in Blast Cleaning and Dust Control Equipment

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

Pangborn

* Trademark of Pangborn Corporation

ROTOBLAST* cleaning SAVES $250.00 a day for General Foundries in MILWAUKEE

● *ROTOBLAST BARREL (above) at General Foundries does work of 4 tumbling mills in 1/4 less time with a saving of 36 man-hours per day.*

Accurate Records Prove ROTOBLAST Makes Important Savings on:

LABOR:

With ROTOBLAST, General Foundries cut cleaning time daily from 54 to 14 man-hours—$100.80 saved per day.

BREAKAGE:

On extremely fragile castings General Foundries reduced breakage 83%, saving $150 a day.

FINISH:

Thorough removal of all burnt-in sand makes machining easier. Saves customers money.

No cost-conscious executive can shrug off the kind of savings General Foundries in Milwaukee has racked up since the installation of Pangborn Rotoblast. Two hundred and fifty dollars daily savings amounts to more than $50,000 saved annually in regular foundry operations. Here's the story in a nutshell!

One Rotoblast Barrel with one operator working one nine-hour shift replaced 4 tumbling mills with two operators working two nine-hour shifts; and a Rotoblast Table Room took over the work of an air blast room, saving $100.80 every day on labor and compressed air costs alone.

WHAT ABOUT YOUR PLANT?

Chances are blast cleaning costs you $5000 to $10,000 *too much* each year. Investigate Pangborn Rotoblast as General Foundries did. Let a Pangborn engineer show you how Rotoblast can increase production and save you big money every year.

WRITE TODAY for Bulletin 214. It contains the complete story and shows typical installations. Included are specifications and a list of prominent users like General Electric, Westinghouse and others. Address your letter to Pangborn Corporation, 1400 Pangborn Blvd., Hagerstown, Md.

MORE THAN 25,000 PANGBORN MACHINES SERVING INDUSTRY

BLAST CLEANS CHEAPER

with the right equipment for every job

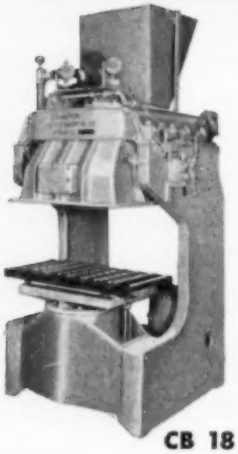
ANOTHER CASE OF *Champion* COST CUTTING

BIG CORES, PRODUCED FASTER, MORE ACCURATELY . . . *AT A HUGE SAVING*

Possibilities of production improvement and cost reduction, through the "Champion method," are well illustrated in the case of a large Midwestern foundry where these views were taken.

Core A, which was made in halves and pasted together, is now blown in one piece, and production has gone up several times, with a very substantial saving in costs. Results obtained with core A proved the practibility of blowing core B, somewhat heavier, also in one piece. Dimensional tolerances of $\frac{1}{32}$ in. are held with ease.

CHAMPION CB 400 CORE BLOWER, "THE BIG BOY"



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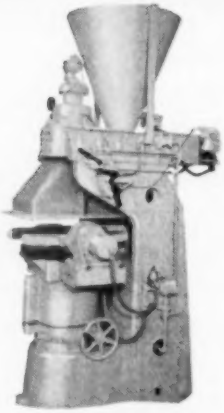

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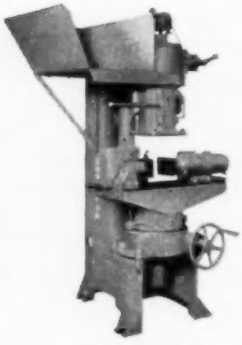
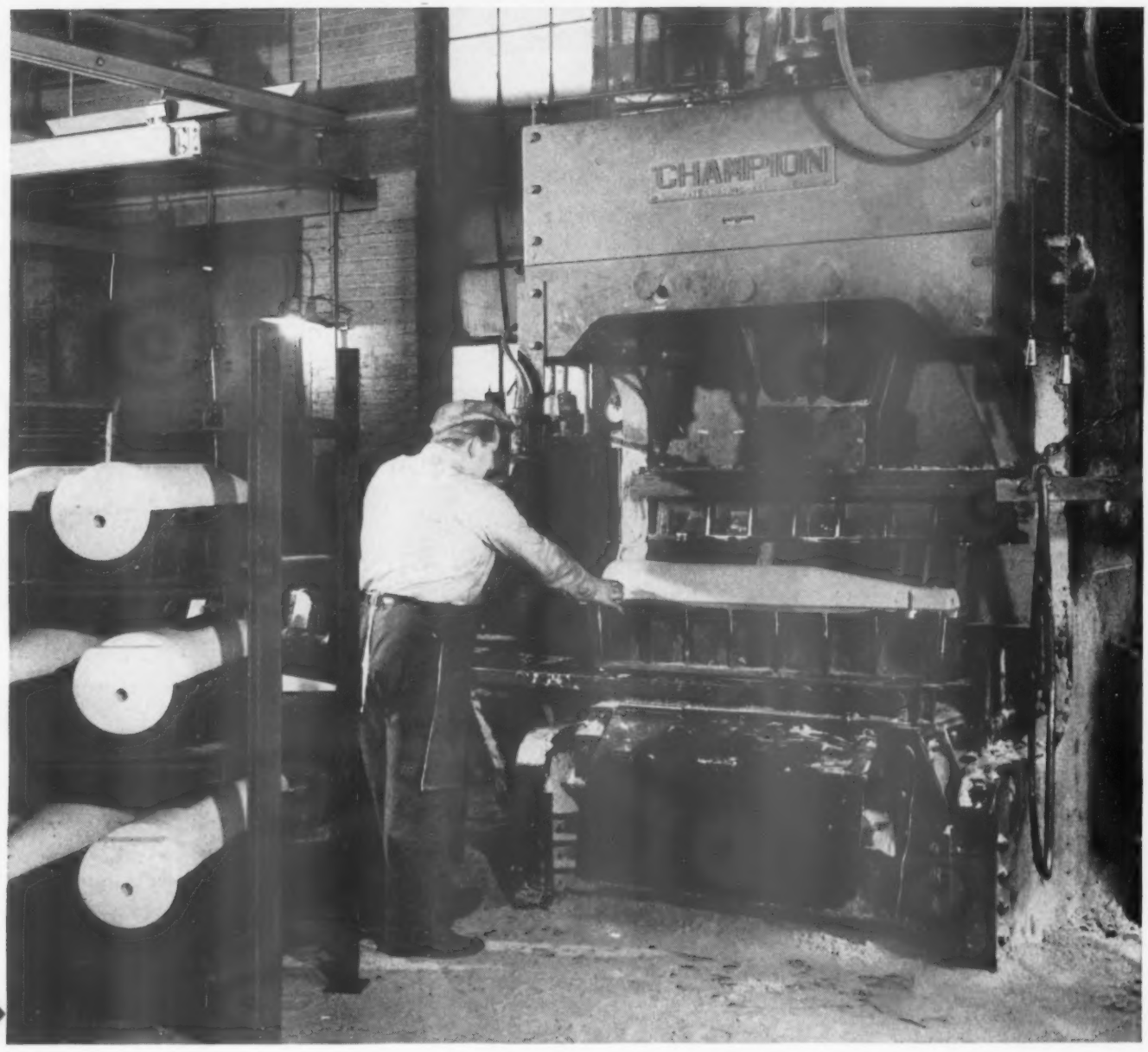


CB 10

CB 5, "JUNIOR"

Examples of time and money savings, of quality improvement, are the usual thing in foundries, large and small, where Champion core blowers and molding machines are used. Let our production specialists show you where and how the Champion method, and Champion machines, can accomplish similar results for you.



Does manpower shortage threaten? Do higher operating costs keep you awake nights? Increase the productivity of your workers, and improve the quality of your product through better cores and molds, made the Champion way!

CHAMPION FOUNDRY AND MACHINE COMPANY

SALES OFFICE, 1553 W. MADISON STREET, CHICAGO 7, ILLINOIS
GENERAL OFFICE AND PLANT • ROCKFORD, ILLINOIS
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W. F. Guth Foundry Engineering, Caixa Postal 1411, Sao Paulo

CHILE
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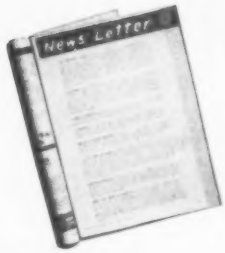
FOUNDRY POINTS THE WAY

for an Industry that's Going Places

Foundry business is good! The need for castings increases daily. Foundrymen are making every effort to catch up with this demand. They are looking into new operating methods, improved production techniques, new equipment and materials, and training new men. This is done in an effort to produce castings more efficiently and in greater volume.

In publishing information and news for foundrymen exclusively, it is FOUNDRY'S business always to look ahead—to serve not only the immediate needs of foundry management and production, but to anticipate trends and future problems.

Looking forward, FOUNDRY believes it can contribute even more to efficient foundry operation and to industry stability through increased editorial service. That's why these new and timely editorial features, among others, are being added. They should provide material that proves more helpful than ever to FOUNDRY'S 45,000 readers in the months ahead.



A Monthly Foundry News Letter

Reporting facts, figures and information gathered for the particular reading of foundrymen, this news feature will carry late developments in Washington and elsewhere as they affect the foundry industry.

An "ABC" Feature Presentation

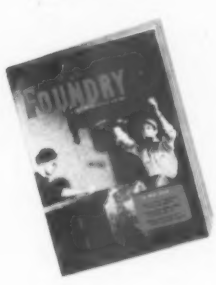
Written especially for the younger generation of foundrymen, this new feature will present each month an interesting, readable review of important phases of foundry technology and operation. The Editors will discuss subjects likely to have a broad reader appeal with young and not-so-young foundrymen alike.

"How-To-Do-It" Features

Believing that in the days ahead there will be even greater need for expediting production through the publication of practical information of the "shop kinks" type, the Editors are expanding this already important service rendered by FOUNDRY.

A NEW Advisory Editor on Cupola Operation

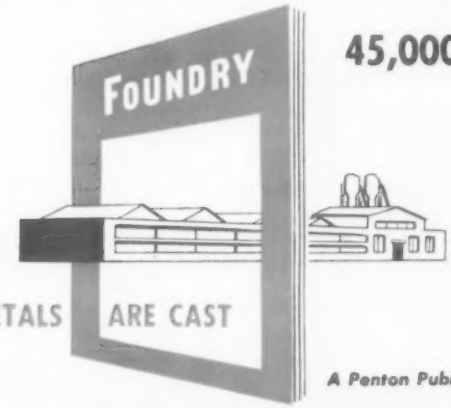
Bernard P. Mulcahy, well-known to foundrymen, joins our Advisory Staff of Editors: John W. Bolton, Albert E. Grover, John Howe Hall, and Harry A. Schwartz. Mr. Mulcahy is a recognized authority on cupola operation and will give invaluable assistance to readers on this important phase of metal melting.



A NEW Cover

Beginning with the January 1951 issue of FOUNDRY, the front cover will be used exclusively by the Editors to feature the editorial content of each issue.

Helping You Sell To Foundrymen



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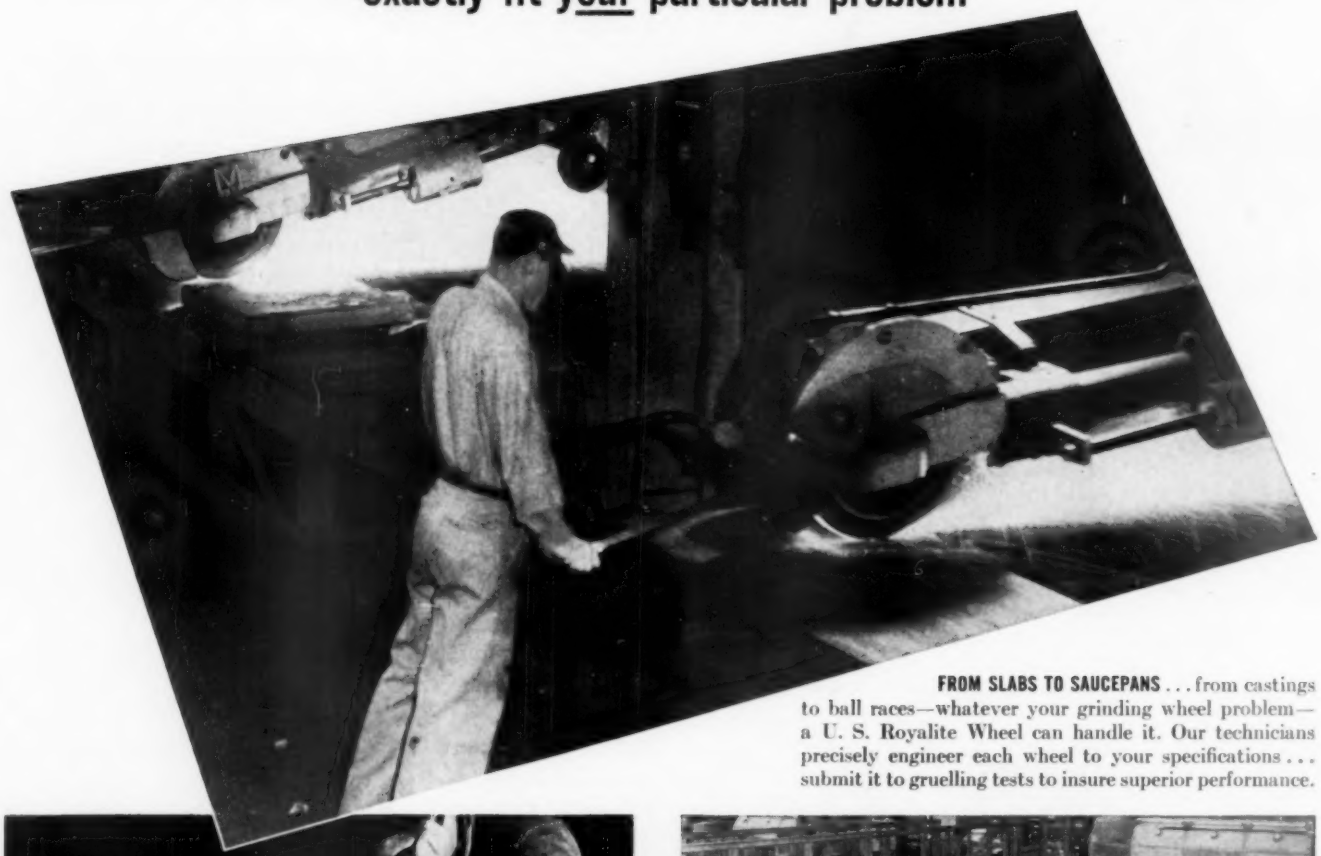
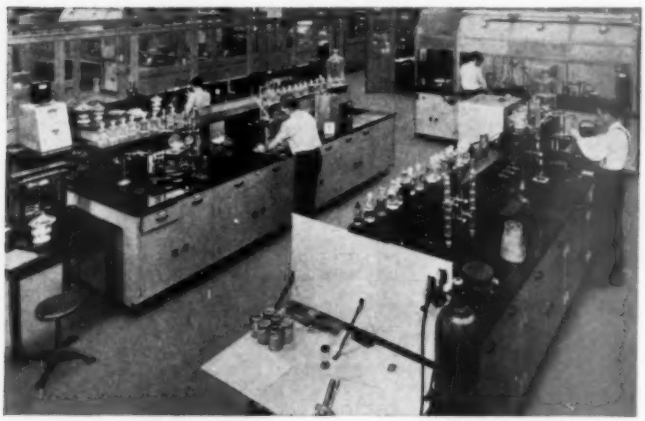
AN AXE TO GRIND?

"U. S." Engineers can develop grinding wheels that exactly fit your particular problem



FROM SLABS TO SAUCEPANS . . . from castings to ball races—whatever your grinding wheel problem—a U. S. Royalite Wheel can handle it. Our technicians precisely engineer each wheel to your specifications . . . submit it to gruelling tests to insure superior performance.

RIGHT FOR THE JOB. 87 years of "U. S." experience and research in bonds and abrasives—and in many other related fields—stand behind every grinding wheel developed. This is your assurance of the right wheel to do the best job.



THIS IS YOUR LABORATORY. Here "U. S." abrasive engineers work to lower your grinding wheel costs. Here they have developed more than 5,000,000 possible combinations of size and construction . . . that have proved more economical and efficient in service.

There's no problem too difficult for our abrasive engineers. Let them give you accurate grinding wheel costs *in advance* and diagnose and solve your problems right in your plant. For complete information, write

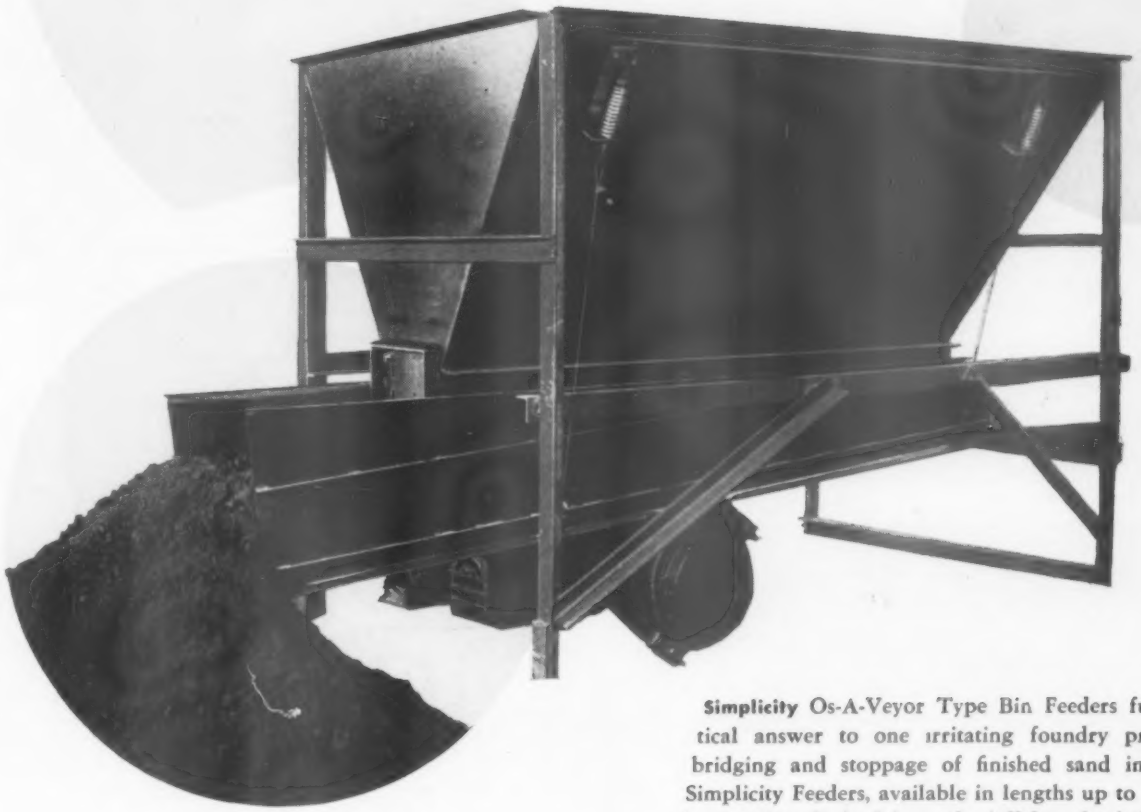
A DEVELOPMENT OF

U.S.RUBBER
SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

GRINDING WHEEL DEPARTMENT • ROCKEFELLER CENTER, NEW YORK 20, N. Y.

SIMPLICITY OS-A-VEYOR BIN FEEDER REDUCES BRIDGING AND STOPPAGE



2′ x 10′ two-surface Os-A-Veyor Type Feeder Installed Under Test Bin.

Simplicity Os-A-Veyor Type Bin Feeders furnish a practical answer to one irritating foundry problem . . . bridging and stoppage of finished sand in storage bins. Simplicity Feeders, available in lengths up to 50′ and widths from 12″ to 6′, *feed from the full length of the bin* with the danger of bridging and hanging greatly reduced. Sand also can temper in the bin with exact length of time dependent on capacity of bin and rate of feed. ✓ ✓ ✓ In actual operations, a 3′ x 17′ two-surface Simplicity Bin Feeder installed at the Buick foundry, Flint, Michigan, handles, *at a uniform controlled rate,* 100 tons per hour of finished, mulled and tempered sand feeding from a 150 ton capacity bin through a 14′ long opening. In this operation, the sand is allowed to temper for 1½ hours before going to the molders. Greater capacities are readily possible if required. ✓ ✓ ✓ Why not investigate Simplicity Os-A-Veyor type bin feeders for your foundry . . . *it'll mean money saved.* A Simplicity sales engineer will be glad to give you the full story on the remarkable new development. 84

Sales representatives in all parts of the U.S.A.

FOR CANADA: Canadian Bridge Engineering Co., Ltd., Walkerville, Ontario.

FOR EXPORT: Brown & Sites, 50 Church St., New York 7, N. Y.

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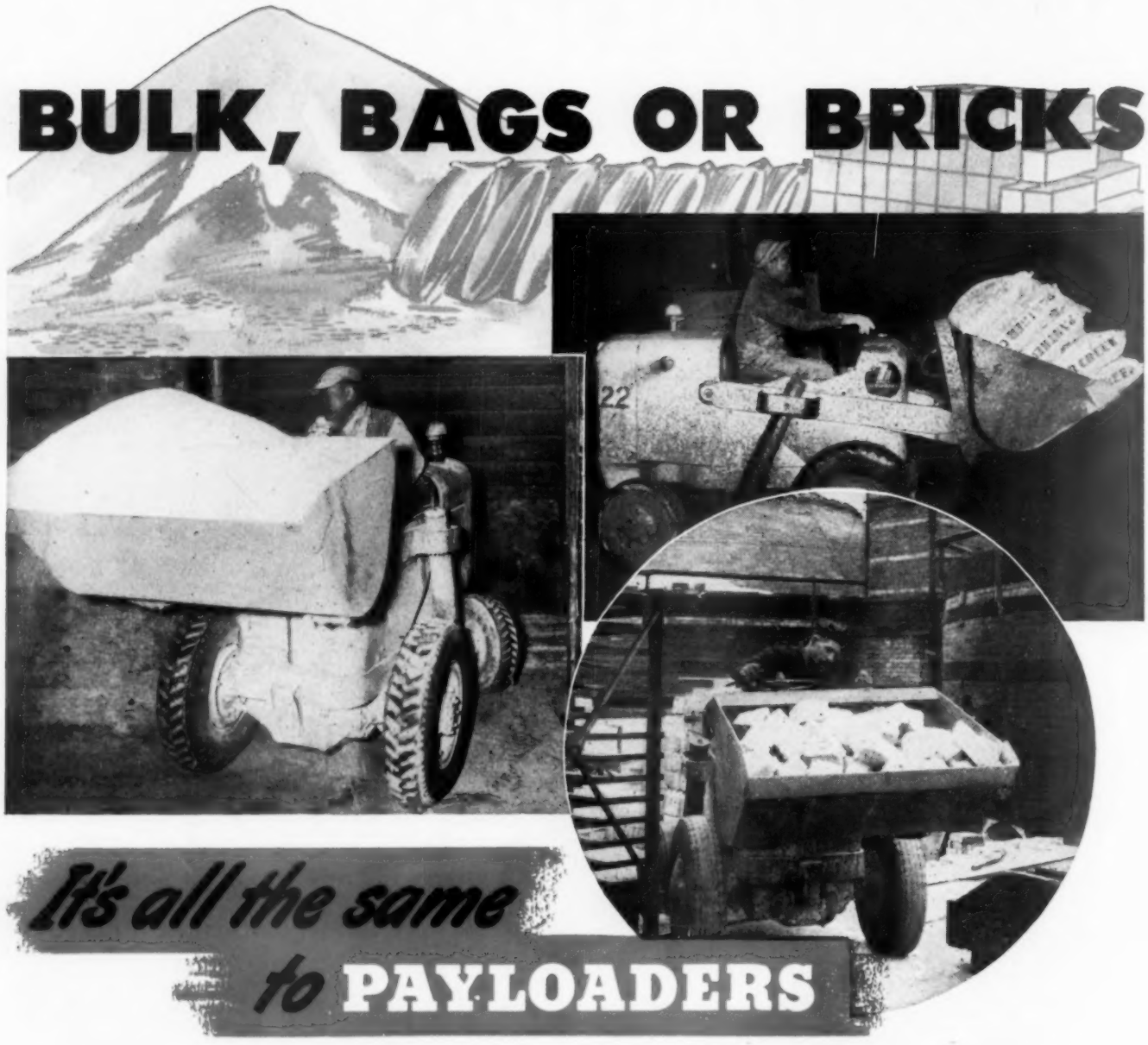


It's all the same to PAYLOADERS

Hundreds of "PAYLOADERS" are at work in foundries . . . saving time and labor, reducing costs, increasing production and adding flexibility to operations. They handle sand, slag, scrap, coke, limestone, waste, bricks, clay, etc. . . . they carry, dump, spread and windrow sand, and load trucks.

"PAYLOADERS" have the power and traction to scoop up big bucket loads of tough, lumpy, granular, sticky or abrasive materials . . . have the speed and maneuverability to carry their loads *fast* outdoors or indoors, over hard surfaces or ground, mud or snow . . . to work in close quarters, to unload box cars. They dump their loads directly into piles, trucks, cars, bins, containers or hoppers—high or low, slow or fast—by means of controlled hydraulic power.

It will pay you to get complete facts about unique unit-design "PAYLOADERS" and how they can serve you . . . facts based on Hough's 29 years of material handling experience and that of the world-wide Distributor Organization that sells and services them. The Frank G. Hough Co., 703 Sunnyside Avenue, Libertyville, Illinois.

Catalogs about "PAYLOADERS" include many varied application photos and job data. They're yours for the asking, covering the 12 cu. ft. Model HA, the ½ yd. Model HE, the ¾ yd. Model HF, the 1¼ yd. Model HL, or the big 1½ yd. Model HM.

SAY "HUFF"

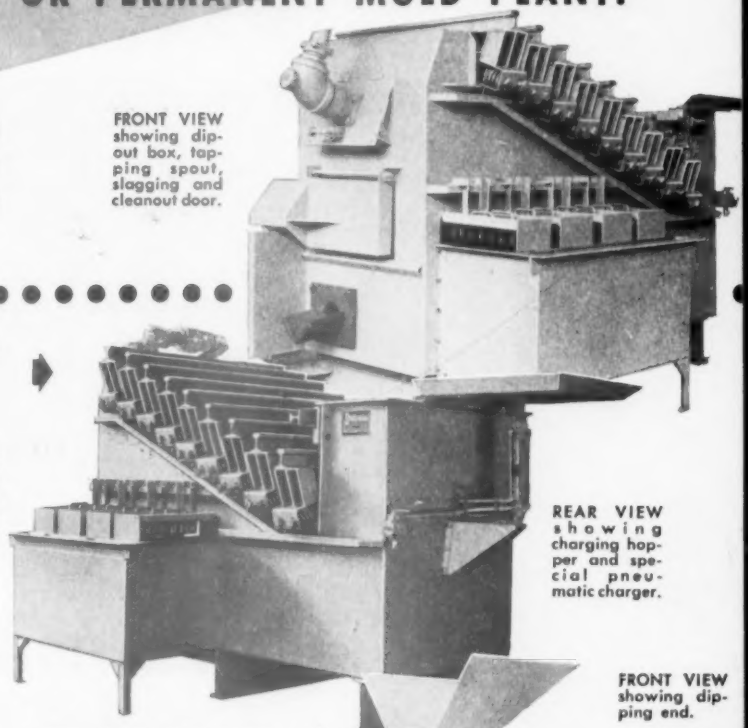
PAYLOADER®

Manufactured by THE FRANK G. HOUGH CO.

STROMAN FURNACES

FOR *Every* ALUMINUM MELTING JOB IN *Any* FOUNDRY, DIE CASTING OR PERMANENT MOLD PLANT!

Stroman builds the most efficient, fastest melting and most economical furnaces available. One of these famous four will handle your every melting requirement at great savings.



FRONT VIEW showing dip-out box, tapping spout, slagging and cleanout door.

REAR VIEW showing charging hopper and special pneumatic charger.

STROMAN TYPE "MC" ALUMINUM DIP-OUT REVERBERATORY FURNACE

Bath capacity from 500 to 10,000 lbs. Aluminum

A combination of breakdown and holding furnaces makes this the most economical furnace ever designed for aluminum melting. It can be used for melting, holding, alloying, fluxing, for either casting or producing ingots. Cold metal does not reach the molten bath. Hot metal is always available for dipping. No iron pots or crucibles to buy. Oil, gas or combination oil-gas fire. Complete automatic controls are available if desired.

FRONT VIEW from charging end showing a Stroman Skip Hoist.

STROMAN ECONOMELT REVERBERATORY FURNACES

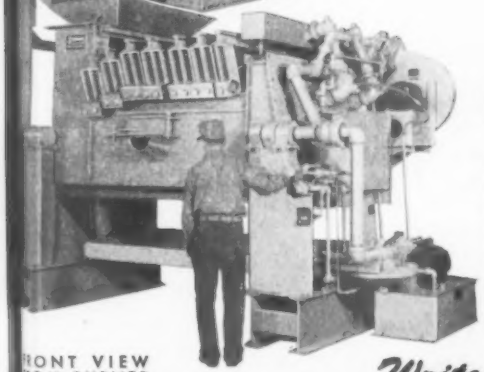
Featuring the famous Stationary Lip Pour which assures a constant pouring arc and eliminates the necessity of moving the ladle at any time during the pour. The Economelt is without a doubt one of the finest reverberatory furnaces ever built. Melting speeds for Aluminum, Brass, Bronze, or Grey Iron are unsurpassed. All metal is preheated and melted in suspension in the throat of the hopper. This furnace is showing upwards of 40% savings in fuel costs. Oil, Gas or Combination Oil-Gas Fire. Charging Hoist and Furnace tilting are operated hydraulically. Hydraulic systems are furnished as complete units including operating valves, etc. Capacity in Aluminum up to 10,000 lbs. total bath. Write for Bulletin No. 635 for complete information.

FRONT VIEW showing dipping end.

STROMAN TYPE "DS" REVERBERATORY FURNACE FOR MELTING ALUMINUM

300 and 500 lbs. bath capacities.

The "DS" Furnace provides a complete melting unit for each Die Casting Machine or Small Permanent Molds. It is a small compact unit that may be easily moved to any desired position in the plant. Eliminates the necessity of having both breakdown and holding furnaces. Saves over 50% in fuel costs over any other type. Ingots and returns are melted where they are cast. There is no handling of hot metal except to the die or mold. Metal is melted in a reducing atmosphere and is free from porosity with little or no dross. Complete automatic controls are available if desired.



FRONT VIEW FROM BURNER END.

STROMAN TYPE "SW" ECONOMELT REVERBERATORY FURNACE

Same as Economelt described above except that it is tilted by an air ram, and does not incorporate Stationary Lip Pour. It is excellent as a breakdown furnace for ingot and returns, in die or sand casting and permanent mold plants. Suitable for re-alloying returns or running back machine shop scrap. A large opening is provided below burner equipment to facilitate such operations as drossing, fluxing, alloying, or puddling back light scrap or returns.

Write for Complete Information at Once

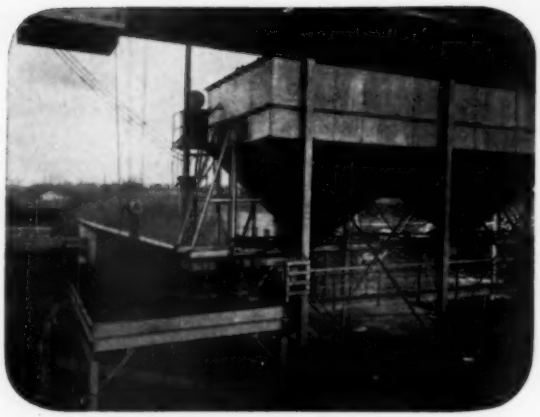
STROMAN FURNACE & ENGINEERING CO.

DIVISION OF

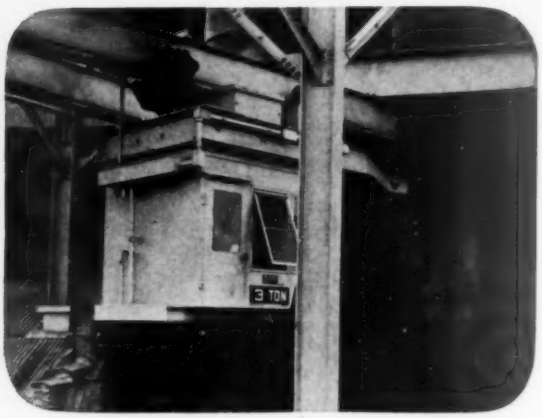
THE PETERSEN OVEN CO. • 9900 FRANKLIN AVE. • FRANKLIN PARK, ILL.

IF IT'S WHITING IT'S ENGINEERED

MAKE-UP and CHARGING

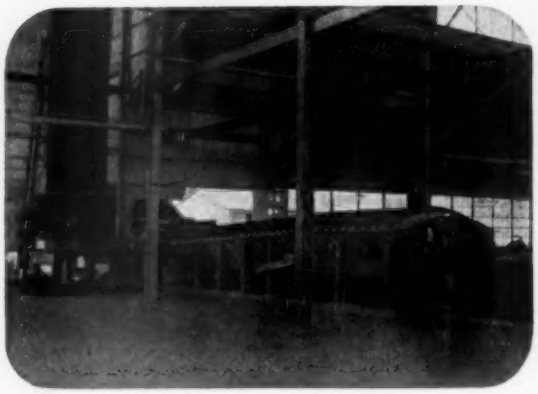


Whiting Equipment handles the charge from yard to cupola. Here a magnet crane is making up the metal charge.

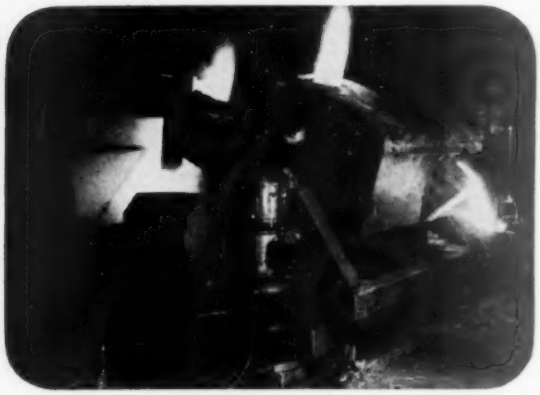


Whiting Mechanical Chargers range from simple skip hoists for a single cupola, to swivel, crane, and monorail chargers.

MELTING and HOLDING



For hot metal at low cost, Whiting Duplexing is available in many combinations—above is cupola to air furnace.



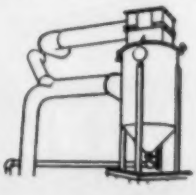
The Whiting Heated Metal Mixer provides uniform hot metal—a real boon where light, thin-section castings are poured.

WHITING Corporation

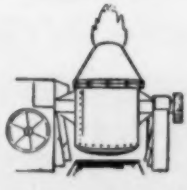
15607 Lathrop Ave. • Harvey, Illinois

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

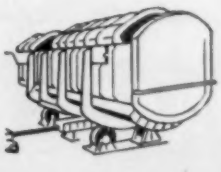
DUST SUPPRESSORS



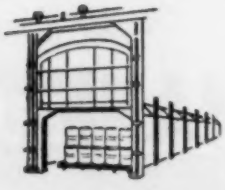
CONVERTERS



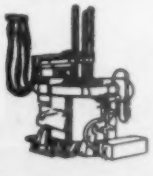
CRADLE FURNACES



ANNEALING OVENS

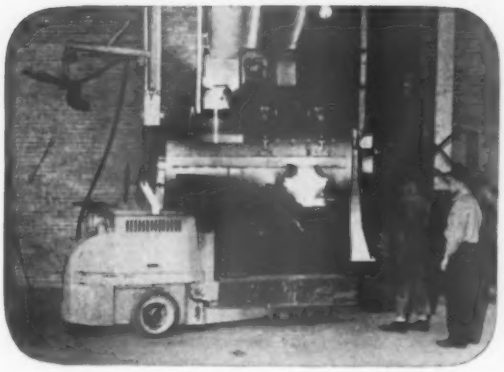


HYDRO-ARC FURNACES



BY PRACTICAL FOUNDRYMEN

DISTRIBUTION and POURING



Here cupola metal flows into a Whiting Mixing Ladle from which it is poured into the distributing ladle. Whiting makes ladles for every foundry use.

Whiting Ladles, Ladle Handlers, and Pouring Systems are designed for pouring ease, safety, and long life—engineered from years of practical foundry experience.

DUST SUPPRESSION

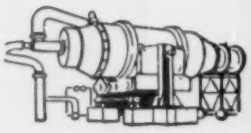
The Whiting Cupola Dust Suppressors control fly ash and sparks with water—reducing all solids to harmless sludge.

Hydro-Clone Dust Suppressors control foundry dusts at their source—at shakeouts, sand-handling systems, etc.

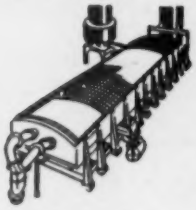
Send the coupon for free literature on any items of Whiting Foundry Equipment . . . or contact the nearest Whiting office if you want to talk with a sales engineer.

Offices in Chicago, Cincinnati, Detroit, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, and St. Louis. Agents in other principal cities. Canadian Subsidiary: Whiting Corporation (Canada) Ltd., Toronto, Ontario. Export Department: 30 Church St., New York 7, N. Y.

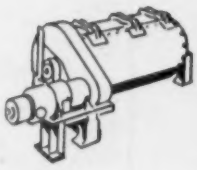
ROTARY FURNACES



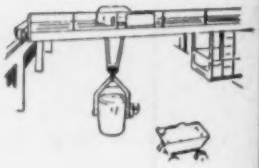
DUPLEXING SYSTEMS



TUMBLERS

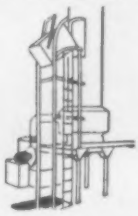


CRANES

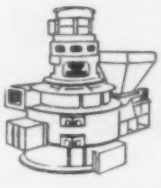


TRAMBEAM SYSTEMS

CUPOLA and CHARGER



PULVERIZERS



LADLES

WHITING CORPORATION
15607 Lathrop Ave., Harvey, Illinois

Please send descriptive literature on the items checked.

☐ Cupolas	☐ Duplexing	☐ Ladles
☐ Elec. Coke Igniters	☐ Cradle Furnaces	☐ Pouring Systems
☐ Chargers	☐ Heated Metal Mixer	☐ Cranes & Hoists
☐ Skip Hoists	☐ Annealing Ovens	☐ Transfer Cars
☐ Electric Furnaces	☐ Converters	☐ Tumblers
☐ Air Furnaces	☐ Pulverizers	☐ Dust Suppressors

Name_____ Title_____

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New.... Improved

DELTA CORE & MOLD WASHES

SPEED PRODUCTION OF BETTER, CLEANER CASTINGS AT *Lower Cost*

Three easy-to-understand reasons why more foundries use DELTA Core and Mold Washes . . .

1. **MORE PERFECT CASTINGS . . .**
2. **LOWER CLEANING ROOM COSTS . . .**
3. **LESS SCRAP IN MACHINING.**

DELTA CORE AND MOLD WASH-BASE
Mix with silica flour and water to produce finished wash.

•

FOR STEEL
STEELKOAT — Special Core and Mold Wash.

•

FOR GRAY IRON AND MALLEABLE
Grakoat — Blackoat — Hi-temp.

•

FOR GRAY IRON
Blackoat S-5 — A new and different wash.

•

FOR NON-FERROUS METALS
Non-FerrusKoat.

•

FOR ALL SAND CAST METALS
THERMOKOAT — It's Plasti-Lastic.
PYROKOAT-HI-Speed.

•

FOR UNUSUALLY HIGH TEMPERATURE CONDITIONS
Z-KOAT — High-fusion-temp. Wash.

•

There is no "just as good" substitute for any DELTA Core and Mold Wash just as there is no substitute for DELTA'S scientific laboratory control of production which safeguards the quality and uniformity of all DELTA Foundry Products. DELTA Research laboratories developed, and pioneered the use of, Plastic-type Core and Mold Washes . . . and still leads the field in the development of new products for improved foundry practices.

NEW mechanical processing and improved chemical formulation . . . developed by DELTA Research . . . have resulted in many decided advancements in both the quality and characteristics of DELTA CORE and MOLD WASHES.

Maximum uniformity of surface coverage is obtained with lower Beaume mixes, using more water. Penetration characteristics are THREE times greater (from 10 to 12 grains deep) and the density of the wash on the surface has been increased 40%.

Due to increased surface density the rate heat conductivity is speeded up and metal in contact with the washed surfaces cools more rapidly, resulting in smoother casting finish.

HERE'S WHY

a. Delta Core and Mold Washes "Anchor" themselves by penetrating from 10 to 12 grains deep into the sand. This bond between the wash and the sand . . . a distinctive DELTA characteristic . . . produces an expansion-resisting coating essential to the production of finer finished castings.

b. The hot strength of Delta Core and Mold Washes increases with each degree of temperature rise from 1800°F to 3000°F providing maximum critical hot strength for all foundry applications.

The higher hot strength of DELTA Core and Mold Washes eliminates surface sand fissuring, excessive sand expansion and distortion.

c. No gas leakage through Delta Core and Mold washed surfaces. Gases produced by decomposition of organic binders in the core sand cannot leak through Delta Core and Mold washed surfaces to contact the molten metal. Only Delta Core and Mold Washes provide this unique and all-important insurance against defective castings resulting from core gas leakage. DELTA Core and Mold Washes insure more perfect castings with finer finished surfaces.

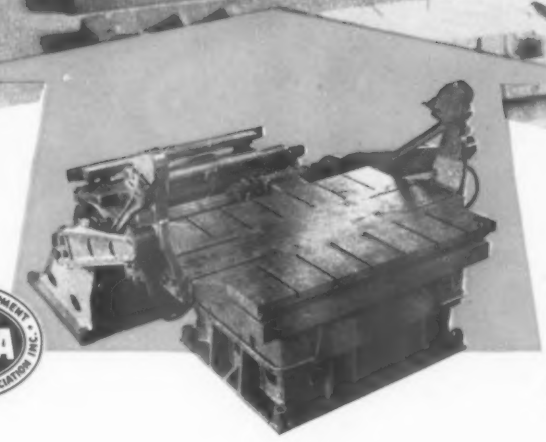
● *Ask for a liberal working sample. You will also receive complete data on how to use DELTA Core and Mold Washes in your foundry.*

DELTA OIL PRODUCTS CO.

MILWAUKEE 9, WISCONSIN

THIS FOUNDRY IS A GOOD PLACE TO WORK

Weil-McLain Company, Michigan City, Indiana



EMPLOYEES of this foundry provide strong evidence that it is a good place to work. Thirty-three per cent (33%) of them have been with the company over twenty years, most of them since the plant started operating, and 70% have been with the company more than ten years.

As a result of its safety program Weil-McLain received national recognition and an award last year for achieving a lost time accident rate 56% below the national average of the industry.

This plant, built in 1919, manufactures cast iron low pressure heating boilers, hot water supply boilers, and a wide variety of component parts. A second plant is operated in Erie, Pennsylvania. Total employment averages 700.

Employee welfare is a daily concern of this foundry's management. Labor-saving, efficient, motorized equipment is used throughout the plant in handling and processing its products.

To help guarantee the smooth flow of castings and assure fast, easy production, Herman Molding Machines are used by this foundry. The 10,000 lb. Jarr Rollover shown is representative of many Herman machines used. A timer controls all jarring. Any size mold is clamped and unclamped instantly. One valve makes the machine easy to operate. For more details, write us today.

Herman MOLDING MACHINES

HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH, PA.

for maximum economy
on every rough grinding job...

NORTON
ABRASIVES

..Specify NORTON WHEELS_

_Wheels with the *Right Combination* of *Cutting Action* and *Long Wheel Life*

YOU foundrymen know just what type of wheels you need to handle your rough grinding jobs quickly, easily and most economically. Maybe **fast cut** spells maximum economy for you. Maybe extra **long wheel life** is your primary requirement. There's a definite combination of cutting action and wheel life that will keep your rough grinding costs down.

Norton can supply wheels with just the combination you need—because of its research facilities, engineering skill and wide product variety. You'll find a Norton wheel with exactly the right combination of abrasive and bond, and in just the right size and shape to produce the cost-cutting results you're after.

Let your Norton distributor or abrasive engineer study your rough grinding jobs and help you to select Norton wheels of ALUNDUM, 15 ALUNDUM, 57 ALUNDUM or CRYSTOLON abrasive and B-5, B-7, B-H resinoid or vitrified bond. He'll help you to select exactly the right wheels for maximum economy on each operation.

You'll find many helpful rough grinding tips and scores of cost-cutting specifications in the Norton booklet, "Rough Grinding." Send for your copy of Form 1405-A-2.

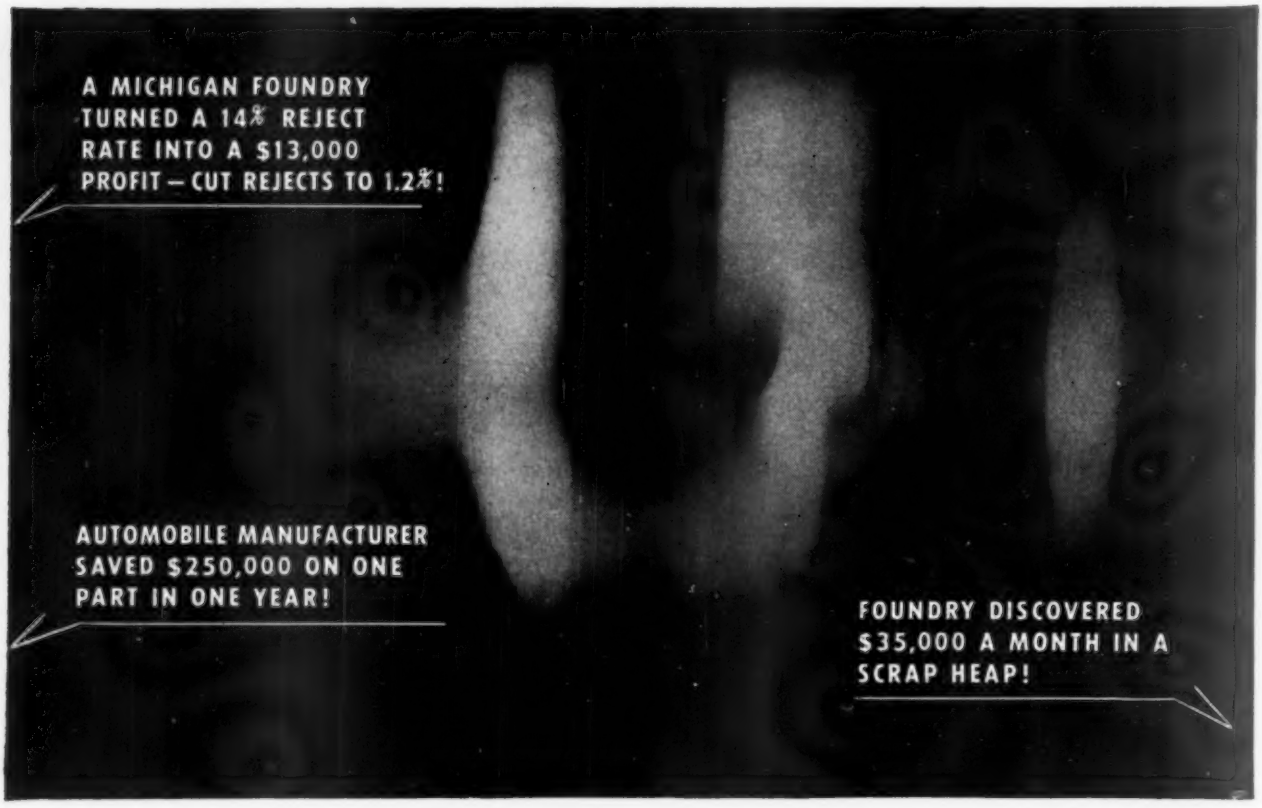
NORTON COMPANY
WORCESTER 6, MASS.

Distributors in All Principal Cities

W-1328

Making better products to make other products better

INDUSTRIAL X-RAY one of management's surest instruments for cutting cost!


A MICHIGAN FOUNDRY TURNED A 14% REJECT RATE INTO A $13,000 PROFIT—CUT REJECTS TO 1.2%!
AUTOMOBILE MANUFACTURER SAVED $250,000 ON ONE PART IN ONE YEAR!
FOUNDRY DISCOVERED $35,000 A MONTH IN A SCRAP HEAP!

General Electric Industrial X-Ray is a production tool that often pays for itself on the first job!

CAMPBELL, WYANT and CANNON, Muskegon, Michigan: "It is estimated that on . . . two jobs alone, the foundry saved over $13,000 and added to its prestige by delivering castings to its customers in which the latter could have the utmost confidence." RADIOGRAPHY — KEY TO BETTER CASTING DESIGN — The Foundry, November, 1944.

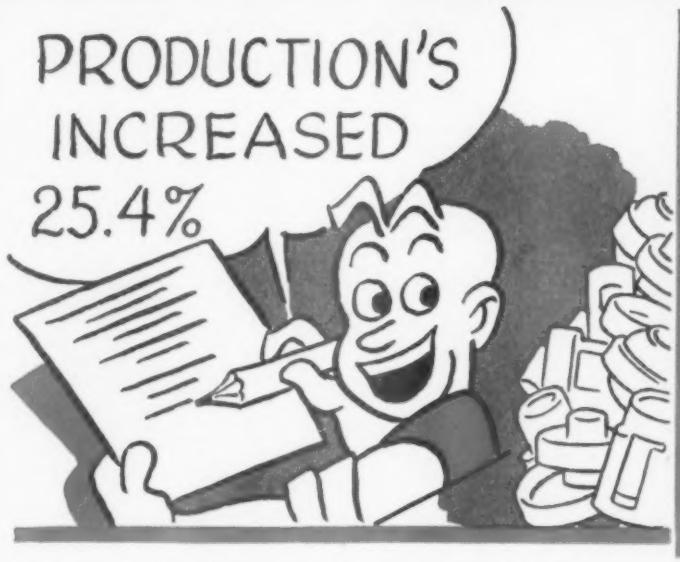
FORD MOTOR COMPANY, Dearborn, Michigan: "An outstanding example of the contribution of radiography to the improvement of production processes resulted when examination of one type of crankshaft showed lack of fusion at the chill and pointed the way to improved techniques resulting in a saving conservatively estimated by the company to be $250,000 on a year's production." RADIOGRAPHIC PRACTICE AT FORD — The Iron Age, July 22, 1948.

OBERDORFER FOUNDRIES, INC., Syracuse, N. Y.: ". . . radiography, as proof of soundness, accounted for the salvaging monthly of $35,000 worth of parts, enabling the foundry to meet delivery requirements and, in addition, to increase its yield and pass on to its customer a 20 per cent savings." X-RAY IN POSTWAR ERA — Steel, July 9, 1945.

And so it goes, this story of savings and profit made possible through radiography. Scores of companies have found that radiography has become a *development* tool, too. It not only diagnoses, but suggests treatment. It shows where savings can be made, designs improved, new techniques developed. Write for booklet: "Radiography as a Foundry Tool." General Electric X-Ray Corp., Dept. YY12, Milwaukee 14, Wisconsin.

Find out how you can get x-ray inspection equipment under the GE Maxiservice Plan. No cash outlay. Monthly service charge covers everything. Write for folder.

GENERAL ELECTRIC X-RAY CORPORATION



Manufacturer* Cuts Blast Cleaning Costs 51.8% with MALLEABRASIVE

Test by Reading Gray Iron Castings Inc., of Reading, Pa. proves Malleabrasive saves 51.8% or $3,908.74 a year on blast cleaning costs in their plant.

If you want to save on blast cleaning costs . . . look at the results of this test made by Reading Gray Iron Castings, Inc. After just seven weeks the test showed that 5,900 lbs. Malleabrasive did the same job as 10,300 lbs. of conventional abrasive... replacement parts costs were down 64.7% . . . production increased 25.4% while the cost per ton cleaned was slashed by 51.8%. Here's concrete proof that Malleabrasive's the best abrasive you can buy!

Make Your Own Test!

We'll send you the data needed to run a comparative test like this right in your own cleaning room! Now you can prove to yourself that Malleabrasive slashes cleaning costs up to 50% and more. Malleabrasive is more than "heat treated" or "annealed". Malleabrasive is guaranteed to outperform ordinary abrasives when comparative tests are properly run.

For full details, plus a copy of other Malleabrasive tests, write for TEST INFORMATION, THE GLOBE STEEL ABRASIVE CO., Mansfield, Ohio.

Packed in new orange striped 100 lb. bags

Save on blast cleaning with

PATENTED† Malleabrasive®

†U.S. Patent #2184926
(other patents pending)

THE GLOBE STEEL ABRASIVE CO., MANSFIELD, OHIO

• MANUFACTURERS OF METAL ABRASIVES SINCE 1907 •

FERROCARBO Briquettes are manufactured under U. S. Patents 2,119,521 and 2,497,745. The process of making cast iron through utilization of silicon carbide is registered under U. S. Patent 2,020,171.

FERROCARBO Briquettes by CARBORUNDUM

TRADE MARK

IMPROVING MACHINABILITY

FERROCARBO Briquettes are a specially processed type of silicon carbide...used effectively as a cupola deoxidizer.

Machining speeds on castings from iron thus treated have been increased while tool life has been extended substantially. Our distributors welcome the opportunity to demonstrate these and other advantages in detail.

THE CARBORUNDUM COMPANY, Bonded Products and Abrasive Grain Division, Niagara Falls, New York

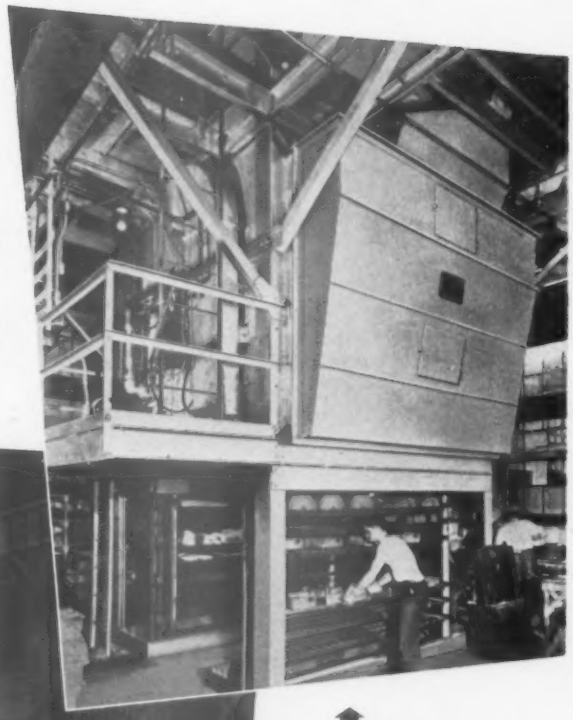
FERROCARBO Distributors: KERCHNER, MARSHALL & CO., PITTSBURGH, Cleveland, Birmingham, Philadelphia and Buffalo; MILLER AND COMPANY, CHICAGO, St. Louis and Cincinnati; WILLIAMS AND WILSON, TORONTO, Montreal and Windsor.

"Carborundum" and "Ferrocarbo" are registered trademarks which indicate manufacture by The Carborundum Company

COLEMAN CORE AND MOLD OVENS

provide

maximum production
better work conditions
lowest operating cost



Coleman Tower® Oven at Monroe Steel Castings Co.

Coleman double-end Car Type Oven at the Birdsboro Steel Foundry & Machine Co.

Throughout the foundry industry, Coleman Core and Mold Ovens are recognized for providing maximum production, better work conditions and lowest costs. Only in Coleman Ovens can you be sure of securing all these advantages:

PERFECT BAKING AND DRYING—eliminating rejects and make-overs.

LOWEST LABOR COST—by utilizing the most efficient handling methods for your production requirements.

MAXIMUM FUEL SAVINGS—using the fuel most economically available to you.

POSITIVE VENTILATION—preventing leakage of fumes and gases and assures better work conditions.

MOST ADVANTAGEOUS USE OF AVAILABLE FLOOR SPACE—through efficient mechanical design.

FLEXIBILITY AND ACCURATE CONTROL—to bake oil or resin binders—whichever is most satisfactory for your casting requirements.

For further information write today for Bulletin 48

A COMPLETE RANGE OF TYPES:
COLEMAN OVENS are built in a complete range of sizes and capacities for every core-baking and mold drying requirement: Tower Ovens, Horizontal Conveyor Ovens, Car-Type Ovens, Transrack Ovens, Rolling Drawer Ovens, Portable Core Ovens, Portable Mold Dryers, etc.

THE FOUNDRY EQUIPMENT COMPANY
1831 COLUMBUS ROAD — CLEVELAND 13, OHIO
MEMBER FEMA
WORLD'S OLDEST AND LARGEST FOUNDRY OVEN SPECIALISTS

compressed air has the *Lifting Power*

I-R Air Hoists have the *Reputation* for lifting loads and profits —raising output —lowering fatigue

Too much human energy is wasted in the nation's industries doing laborious and back-breaking lifting and moving jobs. Agreed? Then let I-R Air Motor Hoists, large and small, eliminate this costly handling! When you use them, output goes up, costs come down.

Sturdy, compact, foolproof I-R Air Hoists are *safe* hoists; because the operator has *complete control* at all times, whether the hoist is running at full speed or at the slowest crawl. Automatic up and down stops prevent damage through misuse to both the hoist and the load. I-R Air Hoists are fine for rugged service, and work just as well in hot gaseous atmospheres.

You can't go wrong when I-R Hoists are on the job. Sizes available from 200 to 20,000 pounds capacities. Ask one of our Air Tool Specialists to show you how *Air Hoists and Air Tools now pay for themselves nearly twice as fast and enable the workman to do more work with less effort.*

AIR POWER
The Key to Lower Production Costs

Ingersoll-Rand
11 Broadway, New York 4, N. Y.

539-8

MOLD DRYING TIME REDUCED *to a minimum*

Automatic Features

ARE INCORPORATED IN

NEW Mold Drying Ovens

by

CARL-MAYER

From an article in May, 1950 issue of The Foundry

PICTURED here are views of two new modern drying ovens recently installed in the Oil Well Supply Co.'s foundry located in Oil City, Pa. This U. S. Steel subsidiary manufactures oil country machinery of all types and its foundries produce a wide weight range of both iron and steel castings, many of which are cast in dry sand molds. Through the medium of forced circulation and recirculation of hot gases or products of combustion, mold drying time is reduced to a minimum.

Each oven, having a capacity of 120,000 lb, is loaded by a mold-carrying car permanently connected to an under-the-floor automatic car pulling device, which by means of limit switches, cannot be operated until the oven door is wide open. Heat is produced in a dual fuel combustion chamber on top the oven, with an external mix type burner using either natural gas or fuel oil, the burners being provided with automatic fuel changeover devices as well as shutdown safety devices in case of fuel or power failures.

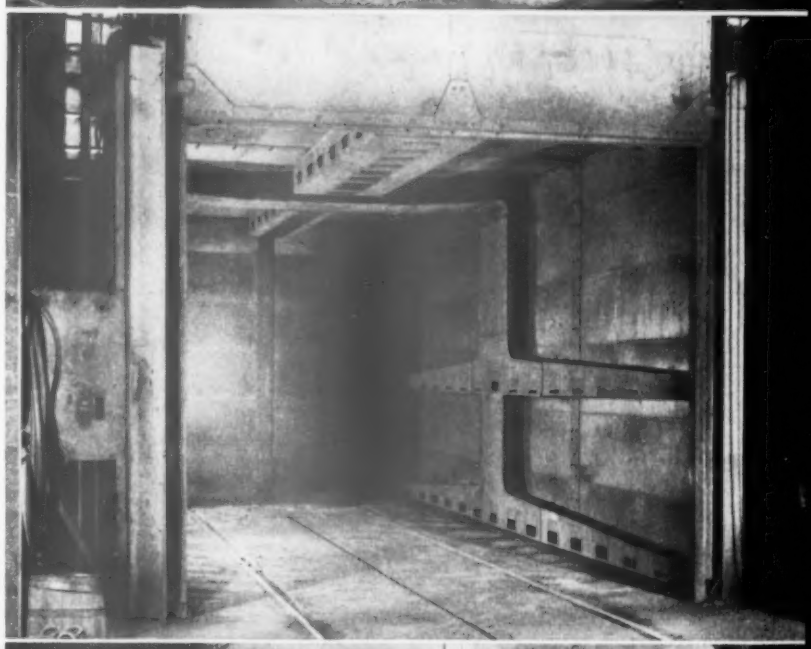
The combustion chamber, which consists of an insulation-covered stainless steel inner lining encased in a steel housing, is connected to a high-temperature fan of 13,000 cfm capacity, forcing the products of combustion through ducts discharging at floor level along both sides of the oven. The circulated hot gases are drawn out through ceiling ducts and about 70 per cent again go through the combustion chamber and are recirculated.

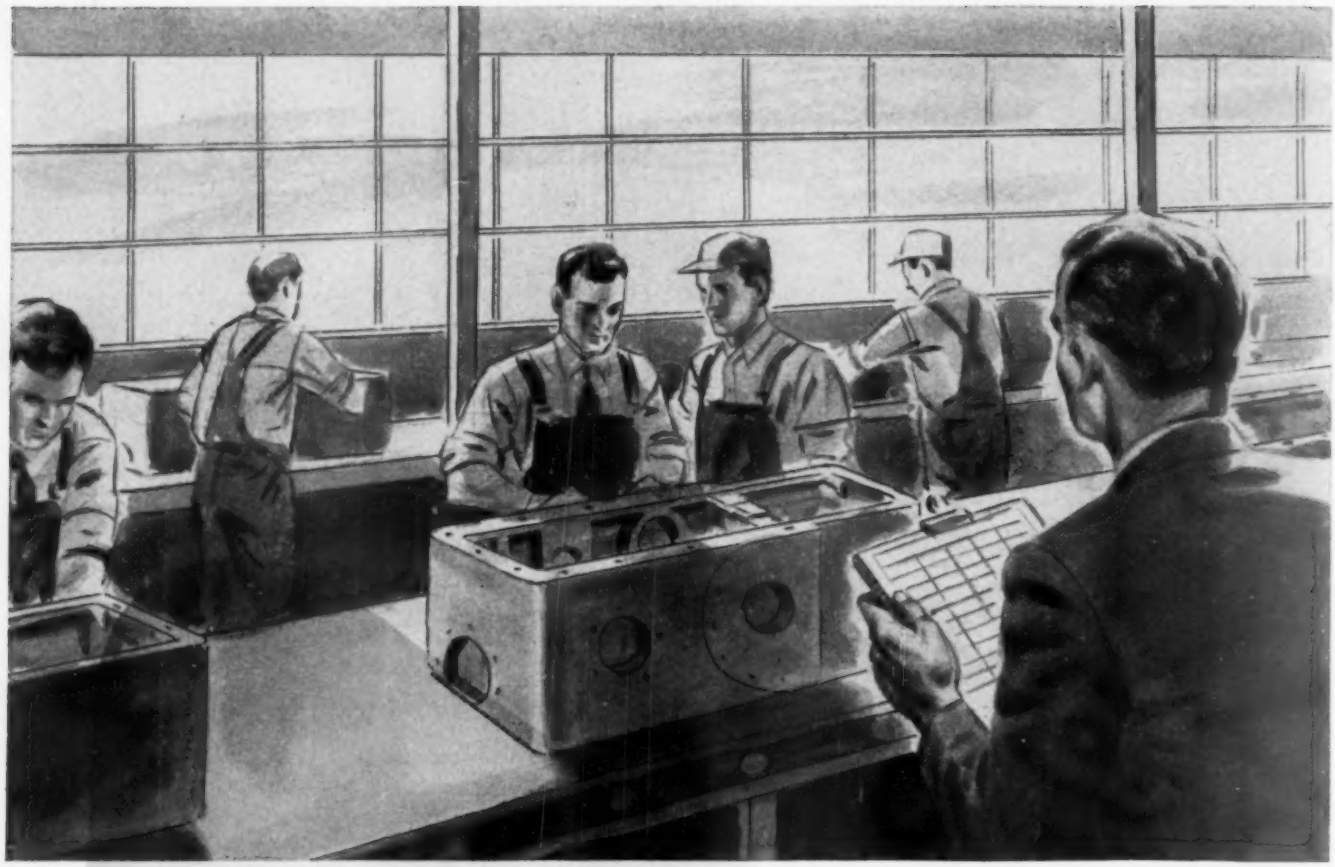
Prefabricated double wall sections, consisting of 5-in. thick glass wool insulation covered by 14 gage steel sheets, make up the oven walls and ceilings, and reduce firing time to 65 per cent of the mold drying time. The drying time cycle is completely automatic and in addition to the many safety protection devices, there is a delayed time firing device whereby the ovens are completely purged of any residual gases before the combustion chamber is ignited. The units were designed, fabricated and installed by

The Carl-Mayer Corp.

3030 Euclid Ave., Cleveland, Ohio

Over thirty years' experience in building all types of Core and Mold Ovens.





transmission cases

QUICK DRYING, non-bleeding, heat and hot oil resistant, non-toxic and durable under all weather conditions—these are just a few of the many specifications a sealer for transmission cases must meet. In addition, the sealer must not crack or flake away from the machined surfaces.

Leading automotive manufacturers are being supplied such a sealer by Tousey—and are using it successfully.

Information about all types of sealers developed by Tousey is available upon request.

A copy of our book "65 years of achievement"—the story behind the Tousey organization—is yours for the asking. It is profusely illustrated and you'll find it interesting reading.

TOUSEY PRODUCTS
CASTING SEALER

TOUSEY FINISHES CAN TAKE IT!

TOUSEY VARNISH CO.

520 WEST 25TH STREET, CHICAGO 16, ILLINOIS

Cuts Core Handling—Storage!

Reduces Core Making Time From Days To Minutes

THE BIG SAVINGS you get by using the *Foundromatic* Sand Core Dryer stem chiefly from cutting storage space and handling labor. Just how big your savings could be depends on labor and overhead charges in your plant.

Add to this, fuel savings of 30 to 80% (depending on the type of binder you are now using) . . . plus a saving in drying time up to 80% and you begin to see the tremendous advantage of this revolutionary new system.

END OVERBAKING OF CORES

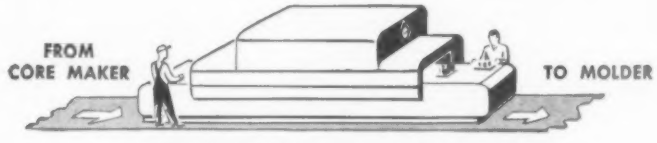
In addition, overbaking of cores is impossible. Ends burning of fins or thin sections of cores. Practically eliminates rejects.

Working conditions are improved too. Fumes and heat are eliminated from the core room, because all the heat that is generated goes into the core.

Any core that will pass through an aperture 36 inches wide and 13 inches high can be dried in the *Foundromatic* sand core dryer.

Allis-Chalmers engineers are prepared to help you. Their experience is based on several years of development work in A-C's huge foundries where electronic skills and real foundry practice were combined.

A-3097



FOUNDROMATIC CORE DRYER

FOUNDROMATIC DRYER WAY

OLD WAY

3 STEPS YOU CAN ELIMINATE

1. Eliminate collecting racks. Cores are placed directly onto the moving conveyor belt of the *Foundromatic* Sand Core dryer.

2. Eliminate cooling racks. When cores come out of dryer, they're cool enough to be handled bare-handed.

3. Eliminate curing and storage racks. Cores can be made as needed in a matter of minutes, without building stocks on curing and storage racks.

Foundromatic is an Allis-Chalmers trademark.

ALLIS-CHALMERS

ALLIS-CHALMERS, 1032A SO. 70 ST.
MILWAUKEE, WIS.

Please send information on the *Foundromatic* Sand Core Dryer.

Name.....

Title.....

Company.....

Street.....

City..... State.....

Get more heats... with TASIL linings for your Detroit Electric Furnaces

Modern foundries are reporting outstanding results from TASIL linings in Detroit Electric Furnaces for melting grey iron, Ni-Hard and Ni-Resist, malleable iron and the complete range of copper-base, non-ferrous alloys. TASIL linings stand up for more heats with minimum patching, lowering the refractory cost per ton of metal melted.

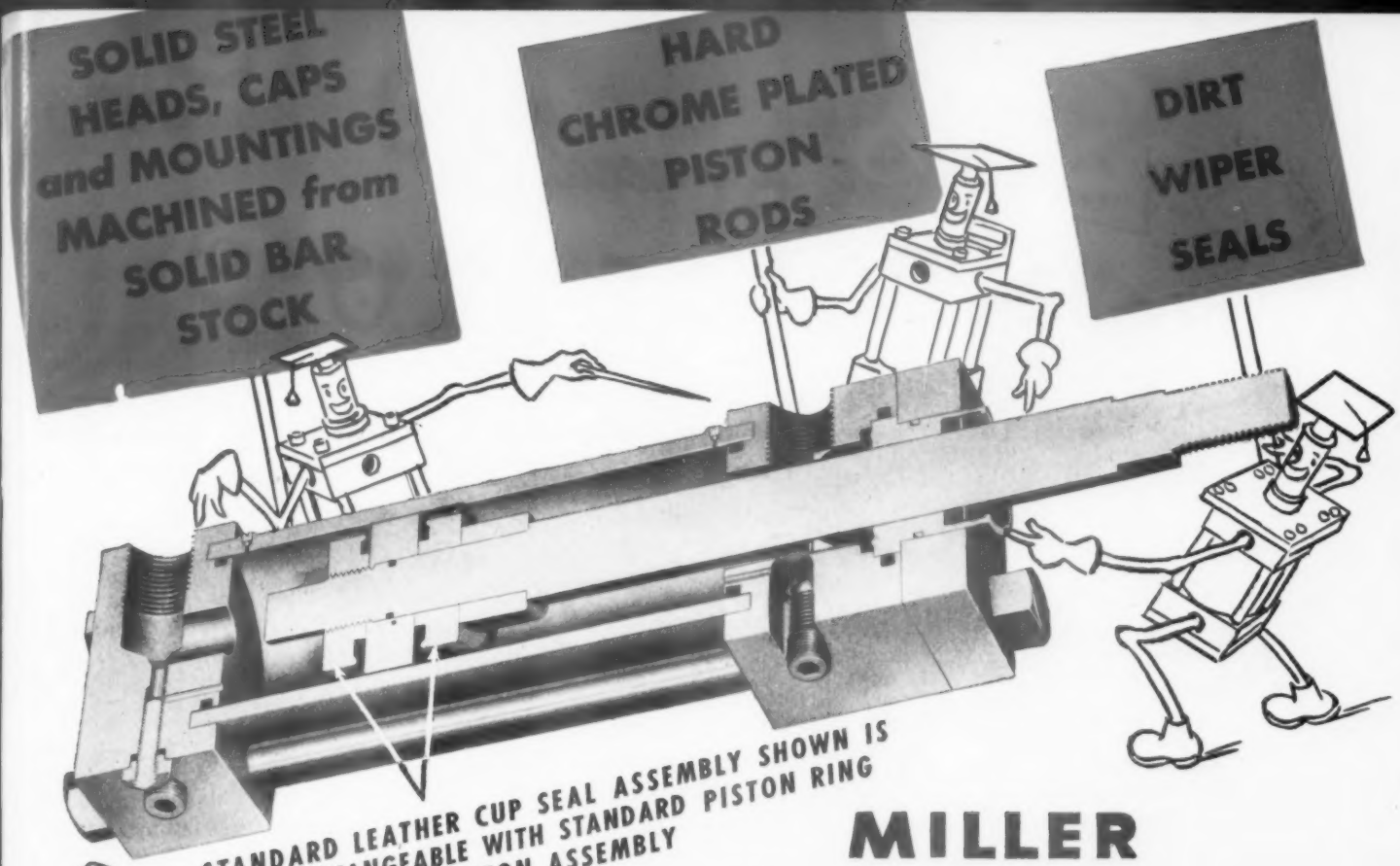
TASIL refractories possess many desirable properties that increase furnace lining life. They have high hot load strength; high softening point (3335°); high volume stability throughout the temperature range; excellent resistance to spalling and slagging.

TASIL refractories are endorsed by the Detroit Electric Furnace Division, Kuhlman Electric Company and are made to their specification. TASIL brick and special shapes, as well as Patches and Cements specifically "engineered" for maintaining Detroit Electric Furnace linings are stocked for prompt shipment. See the Taylor representative in your area or write for details on how you can get more heats, and lower your furnace refractory costs with TASIL.

Refractorers to industry since 1864.

Exclusive Agents in Canada:
REFRACTORIES ENGINEERING AND SUPPLIES, LTD.
Hamilton and Montreal

The CHAS. TAYLOR SONS Co.
REG. U. S. PAT. OFF.
MANUFACTURERS OF REFRACTORIES • CINCINNATI • OHIO • U. S. A.



STANDARD LEATHER CUP SEAL ASSEMBLY SHOWN IS INTERCHANGEABLE WITH STANDARD PISTON RING PISTON ASSEMBLY

MILLER *High Pressure* HYDRAULIC CYLINDERS

Meet J. I. C. HYDRAULIC STANDARDS

Years before the Joint Industry Conference (J. I. C.) Standards for specifying "quality" hydraulic equipment were adopted, the *standard* design and construction features of Miller High Pressure Hydraulic (2000-3500 psi) Cylinders already included ALL the specifications for cylinders, seals and pistons now called for by the "Standards". Hard chrome plated, scratch-resistant piston rods and dirt wipers have long been standard Miller cylinder features yet are required by the "Standards" only under severe conditions.

Solid steel heads, caps and mountings which eliminate costly, dangerous breakage even under the severest operating conditions represent an "extra-quality" standard Miller cylinder feature which actually exceeds the high quality set by the J. I. C. Standards.

The Miller "Patented" Hydraulic Piston Rod Seal which has no manual adjustment and is automatically self-adjusting and wear-compensating to give life-long leakproof service without ever requiring any manual adjustment whatsoever . . . far surpasses the requirement of J. I. C. Standard H6.2.5 which specifies "Stuffing boxes for automatic packing shall be so designed as to prevent adjustment beyond the functional limits of the packing"

Benefits to You

No Broken Castings

No Scratch-Damage to Piston Rods, Bushings and Seals

NO COSTLY "DOWNTIME"
NO REPAIRS
NO MAINTENANCE
NO POWER WASTAGE

Sales and Service from coast to coast

Write for illustrated cylinder bulletins A-105 and H-104

COMPLETE MILLER CYLINDER LINE INCLUDES: AIR CYLINDERS, 1½" to 20" BORES, 200 PSI OPERATION; LOW PRESSURE HYDRAULIC CYLINDERS, 1½" TO 6" BORES FOR 500 PSI OPERATION, 8" TO 14" BORES FOR 250 PSI; HIGH PRESSURE HYDRAULIC CYLINDERS, 1½" TO 12" BORES, 2000-3000 PSI OPERATION. ALL MOUNTING STYLES AVAILABLE.

MILLER MOTOR COMPANY

4025-33 N. KEDZIE AVENUE CHICAGO 18, ILLINOIS

AIR AND HYDRAULIC CYLINDERS · ACCUMULATORS · COUNTERBALANCE CYLINDERS · BOOSTERS · AIR HOISTS

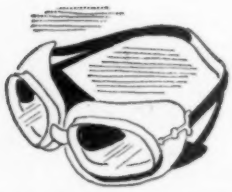
CLEVELAND — PITTSBURGH — PHILADELPHIA — DETROIT — YOUNGSTOWN — BOSTON
HARTFORD — NEW YORK CITY — DAYTON — ST. PAUL — FORT WAYNE — INDIANAPOLIS
MILWAUKEE — NASHVILLE — SEATTLE — LOS ANGELES — SAN FRANCISCO — BALTIMORE
ST. LOUIS and OTHER AREAS

When you need Air

DAY and NIGHT . . .

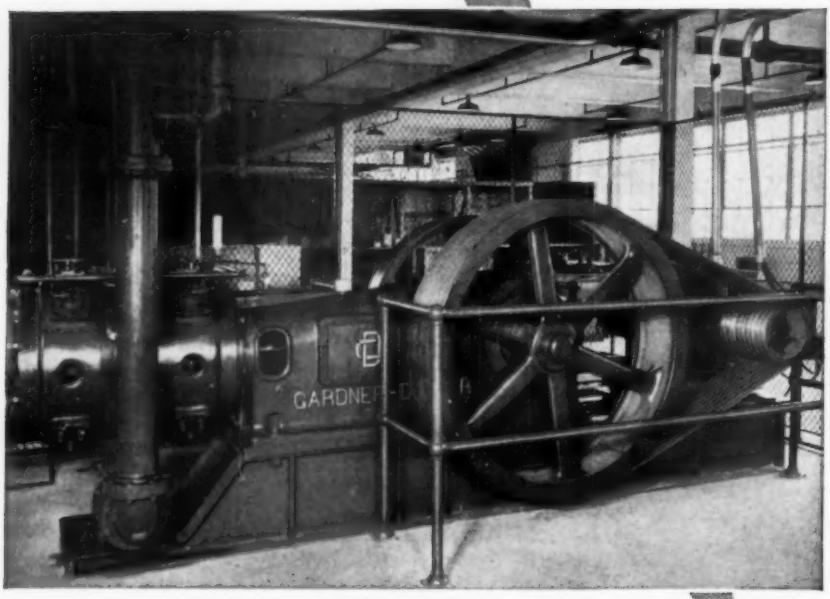
Choose a Gardner-Denver RX Compressor — famous for economy and efficiency under continuous, full-load, heavy-duty service. You'll find volumetric and mechanical efficiencies are high — power costs unusually low. Check these RX advantages — then write for complete information.

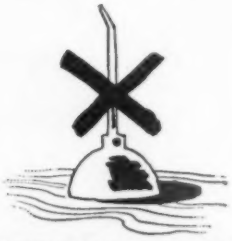
LARGE VALVE AND PORT AREAS
ASSURE UNRESTRICTED AIR FLOW



ENCLOSED MAIN FRAME
PROVIDES PROTECTION AGAINST DUST AND DIRT

AIR-CUSHIONED VALVES
QUIET, DURABLE, AND EFFICIENT





AUTOMATIC LUBRICATION
POSITIVE AND TROUBLE FREE

AUTOMATIC CONTROL
LIMITS POWER CONSUMPTION TO AIR DEMAND

WIDE RANGE OF SIZES
ASSURES CAPACITY AND PRESSURE TO FIT YOUR NEEDS EXACTLY

Gardner-Denver RX Single-Stage, Water-Cooled Compressors are made in capacities from 89 to 1292 cubic feet displacement per minute, for pressures from 20 to 150 pounds. Write for illustrated bulletin.

Since 1859

GARDNER-DENVER

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada) Ltd., Toronto, Ontario

GOOD SALESMEN PLAY SANTA CLAUS

Salesmen are living channels through which the experience, skill and background of America's leading industries are made available to us. From them we learn about new methods, new products, new techniques. Good salesmen, like Santa Claus, bring us gifts of ideas that will help us improve our products, cut costs, spread production. That's why we never close our doors or minds to salesmen here at AMERICAN. And we try to load up our salesmen with ideas for YOU!

DUSTUBE PROVES "ECONOMICAL and DEPENDABLE"

at Superior Steel & Malleable Castings Co., Benton Harbor, Mich.

ASSISTANT GENERAL MANAGER
Mr. L. D. Reiff

"Dustube — it's a big word in dust collection. Proved by heavy duty dependable service on our two biggest dust creating operations — sand mixing and blast cleaning. We have found them to be most economical and most dependable. They can't be beat for efficiency and they cost us just a few pennies a day to operate. The way they eliminated our dust problems convinced us that, 'It pays to own a Dustube'."

MASTER MECHANIC
Mr. Chester Jollay

"We save both hours and dollars in maintenance with the Dustube Dust Collectors. They have not required any service or repair other than simple lubrication and the occasional replacement of cloth tubes in their years of rugged service. Its simplicity of design appeals to our maintenance gang since thorough inspection is so easy and rapid — no other piece of equipment in our foundry has such a favorable record."

FOUNDRY FOREMAN
Mr. John Burger

"Year after year, under the heaviest dust conditions, the two Dustubes provide us with the highest ventilating efficiency. I have never had a complaint from our men of dusty conditions which is a vital factor in maintaining our good employee relations. The important advantages of the Dustube based on our experience have been high efficiency, minimum operating and maintenance costs and dependable, rugged service."

DUSTUBE ADVANTAGES

BETTER DUST REMOVAL
Simple, fast, thorough. Shortens cleaning time.

POWER SAVINGS
Lower resistance to air flow. Lower air velocities.

HIGH EFFICIENCY
Nearly 100% efficient by convincing tests.

EASE OF INSPECTION
Clean, safe, simple. No parts to remove.

DUSTUBE FILTERS
No abrading metal contacts. Easy to ship, store and handle.

FILTER REPLACEMENT
Takes only a few seconds. Requires no tools.

American WHEELABRATOR & EQUIPMENT CORP.
505 S. Byrkit Street Mishawaka 2, Indiana

Please TURN PAGE

Wheelabrator®

saves
IN CLEANI
for The HERCO FOUNDR

WHEELABRATOR advantages for this user

1. Cleaning is more uniform and thorough.

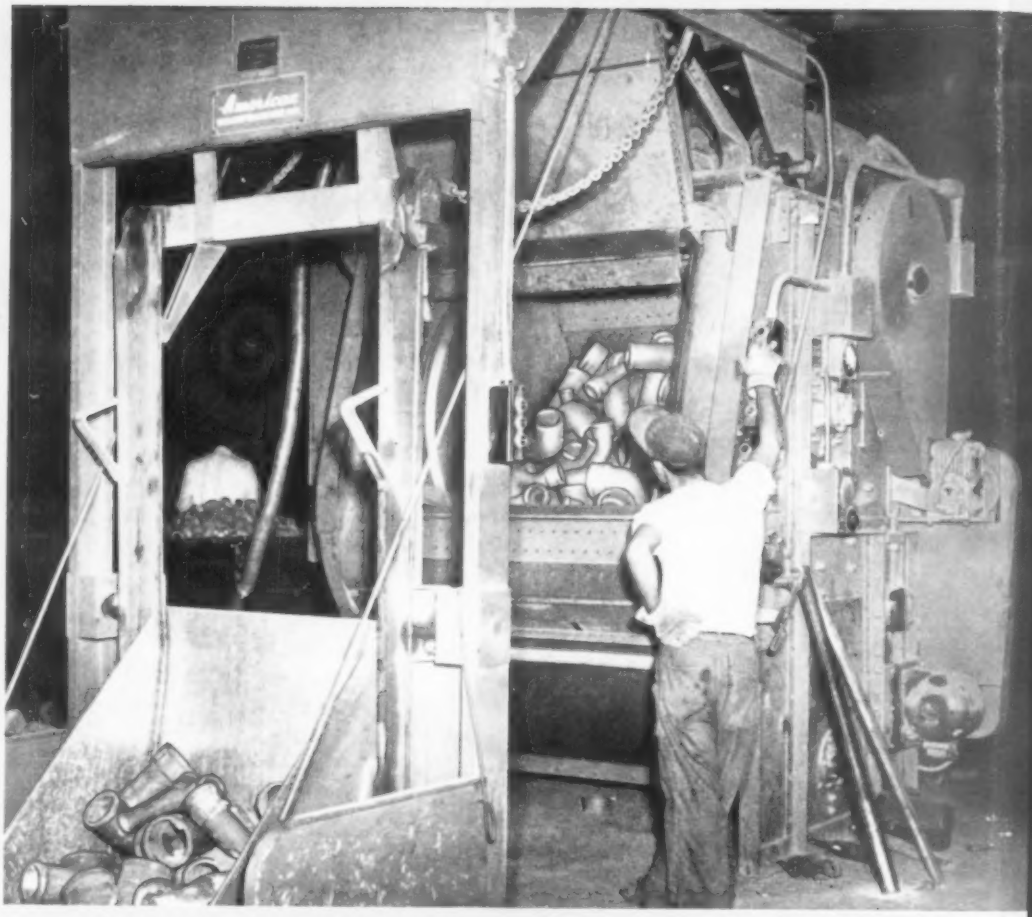
2. Costs have been decreased—a 55% decrease in the cost of cleaning fittings and a 59% reduction in soil pipe cleaning costs.

3. Operations are quiet and dust free.

4. A new standard of cleaning quality has been attained — soil pipe is uniformly cleaned with every trace of sand completely removed.

5. Customers are enthusiastic about the new appearance.

6. Cleaning time and labor requirements are drastically reduced.



Use of this Wheelabrator Tumblast for cleaning soil pipe fittings slashed cleaning costs $3.13 per ton.

It costs less than half as much to clean soil pipe and soil pipe fittings at Herco Foundry, Inc., one of the leading producers on the West Coast, since they started using Wheelabrator Equipment. Where five tumbling mills were formerly required, only two Wheelabrator machines are now used . . . and they clean 43% more work each day.

A Wheelabrator Tumblast cleans soil pipe fittings for $2.14 a ton, compared to $5.27 a ton by former methods.

A Wheelabrator Cabinet cleans the long pieces of soil pipe quickly and thoroughly with decreased manual handling. As a result cleaning time has been cut to a

THE AMERICAN MOLDER

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

Please TURN PAGE

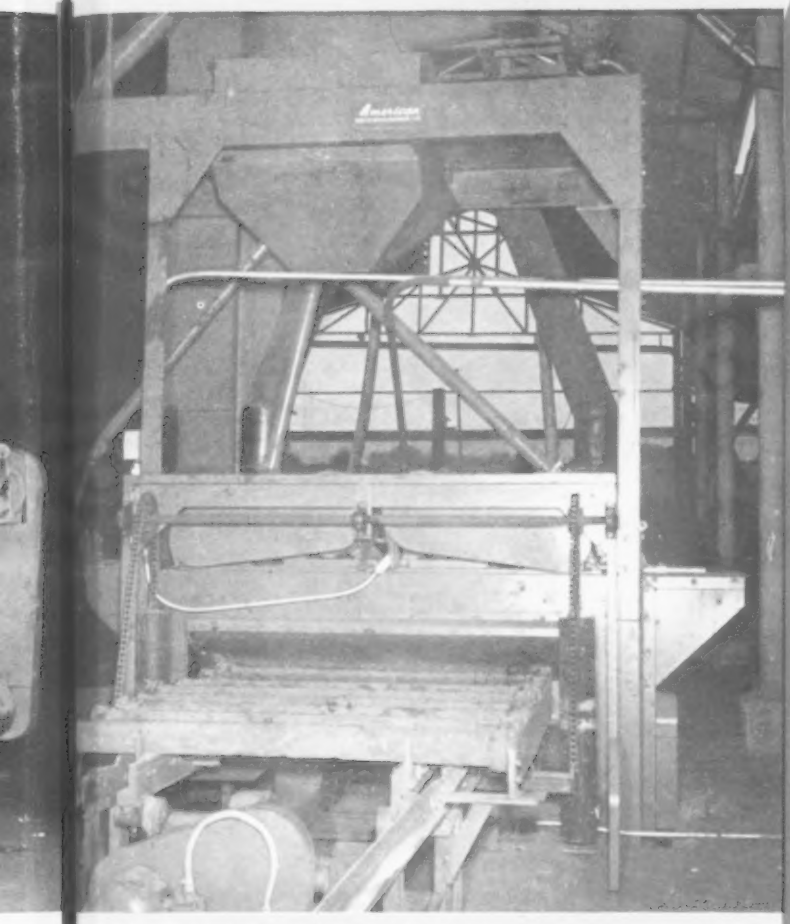
Manufacturing Licensees for Continental Europe: George Fischer, Ltd., Schaffhausen, Switzerland; for British Empire, excluding Canada; Tilghman's Patent Sand Blast Co., Ltd. Broadheath, Nr. Manchester, England. SALES REPRESENTATIVES: Brazil — Equipamentos Industriais "Eisa" Ltda.; Argentina — Clarfix S. R. L.; Mexico — Cosco, S. de R. L.; Puerto Rico — Angel Cobiella.

American

ves $20,239 annually

ANNG SOIL PIPE and FITTINGS

DR INC., South Gate, Calif.



This Wheelabrator Special Cabinet replaced three tumbling mills and decreased labor requirements 37½% for cleaning soil pipe.

minimum and labor requirements have been greatly reduced.

Wheelabrating completely removes every trace of sand to set a new standard of cleaning quality. Herco's customers are enthusiastic about the improved appearance of the products. Wheelabrating is quiet and dust free, in direct contrast with the noise and dirt previously experienced.

There is no sounder investment than a Wheelabrator because it customarily pays for itself out of savings within six to 18 months. Write today for full details.

COST COMPARISON

Charts

SOIL PIPE FITTINGS

	FORMER METHOD	WHEELABRATOR METHOD
MACHINE	2 tumbling mills	48" x 42" Wheelabrator Tumblast (17½ cu. ft. capacity)
LABOR REQUIREMENTS	24 man hours daily	16 man hours daily
COST PER TON	$5.27	$2.14

SAVINGS Per Ton $3.13

SOIL PIPE

	FORMER METHOD	WHEELABRATOR METHOD
MACHINE	3 tumbling mills	Wheelabrator Special Cabinet
LABOR REQUIREMENTS	32 man hours daily	20 man hours daily
COST PER TON	$2.88	$1.28

SAVINGS Per Ton $1.60

WHEELABRATOR & EQUIPMENT CORP.

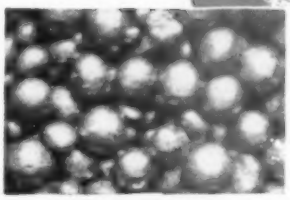
505 S. BYRKIT STREET MISHAWAKA 2, INDIANA

FEMA

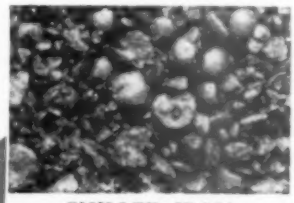
Please TURN PAGE

Casting Service Co., trys TRU-STEEL* shot and saves an additional 33% in abrasive cost

Until you've tried Tru-Steel Shot, you have no way of knowing how little you need spend for abrasive. Maybe you've compared the abrasive you are using with premium abrasive but have you compared it to Tru-Steel? Casting Service Co., La Porte, Indiana made a 3-way test. Where they were saving 21% (by comparison with chilled iron) using a premium abrasive, they now save an additional 33% using Tru-Steel. The facts are contained in the chart at the left.



TRU-STEEL
No. 230 at Mag. 10X
After 1,500 Passes



CHILLED IRON
No. 230 at Mag. 10X
After 50 Passes

COMPARISON CHART

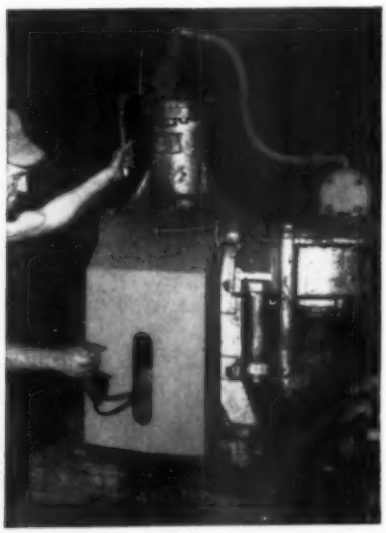
	Cost per pound	Pounds per hour	Shot Cost per hour
CHILLED IRON	$.045	34.7	$1.55
A PREMIUM ABRASIVE	.07	17.3	1.21
TRU-STEEL S-460	.1125	7.14	0.802

*Tru-Steel Shot is manufactured by Steel Shot Producers, Inc., Butler, Pa.

No Abrasive test is complete unless you include TRU-STEEL. Start your test today.

American CORE ROD STRAIGHTENER

saves $10,350 in 300 days



A Pittsburgh steel foundry saved eight men's pay by purchasing two AMERICAN Rod Machines equipped with gagger forming attachment. Fifteen men were formerly employed to straighten, shear and sort core rods and gaggers. AMERICAN Rod Machines reduced the gang to seven men — over 50% saving in labor alone!

If core rod costs are a problem because of costly hand straightening or excessive purchases of new stock, you can save real money with a Core Rod Straightener.

It will straighten bent core rods or cut rods to size as fast as material can be fed into it. The attachment for making gaggers is optional.

Learn how to squeeze money from a scrap pile. Write today for Bulletin No. 10B.

Please TURN PAGE

American WHEELABRATOR & EQUIPMENT CORP.
505 S. Byrkit Street Mishawaka 2, Indiana

THE

Assured Quality

The quality of any weld—its strength, ductility, grain structure, machinability, surface finish—depends largely on the rod used to make it. Only the best rods consistently give good welds of uniformly high quality. Only the best can help you to weld better and faster at lower cost . . . and help to make your job easier, too.

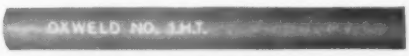
There are two good reasons why OXWELD Welding Rods are the best that modern science knows how to make. First, their rigid specifications are carefully worked out in LINDE research laboratories, which are among the largest and best equipped in the world. Second, LINDE engineers at production points constantly check during manufacture to see that the rods conform to these specifications.

They inspect ingots and billets, sample heats for chemical analysis, make flame and weldability tests, weld and test coupons for strength and ductility. In short, every known precaution is taken to maintain a uniformly high standard.

Every OXWELD Welding Rod that goes to market is of proved physical and chemical analysis . . . free from all objectionable properties and impurities. The OXWELD trade-mark is your guarantee of quality and satisfaction.

The terms "Oxweld," "Prest-O-Weld," and "Purox" are registered trade-marks of Union Carbide and Carbon Corporation.

These 5 Rods Handle a Complete Range of Welding



OXWELD No. 1 H. T. Steel

For all high-strength steel welding. Develops tensile strengths 11,000 lb. per sq. in. higher than ordinary steel.

OXWELD No. 7 Drawn Iron

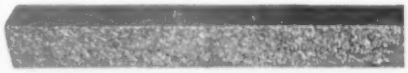
A remarkably ductile, copper-coated rod for all run-of-shop steel welding on materials up to ¼-inch thick.

OXWELD No. 25M Bronze

A superior rod for all braze-welding, building up wearing surfaces, and fusion welding of copper alloys.

OXWELD No. 23 Aluminum

For all-purpose welding of aluminum and its alloys. Prevents weld cracking by absorbing cooling stresses.



OXWELD No. 9 Cast Iron

An ideal rod for fusion welding gray iron castings. Weld metal is fine-grained, soft, and easily machined.

9 additional welding rods and 8 hard-facing rods for more specialized work.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, N. Y.

Offices in Other Principal Cities

In Canada: DOMINION OXYGEN COMPANY, LIMITED, Toronto

Brief Notes for Busy Foundrymen

Have you Tried THIS?

We hesitate to recommend to our readers That they add another ingredient to their molding sands, **but here is a suggestion** which involves both an addition and a subtraction.

Five Star Wood Flour weighs only 10 oz. per quart. Seacoal averages about 32 oz. per quart.

●

Costs can be reduced

and molding results improved by replacing one-fourth of the seacoal with an equal volume of wood flour.

●

The replacement of one out of every four parts of seacoal **means substantial savings** since one ton of wood flour does the work of 3.2 tons of seacoal.

The use of
Five Star Wood Flour
gives the following results:

1. Casting will clean better.
2. Shakeout faster and cleaner.
3. Less loss of sand in the system.
4. Less loss of castings due to scabs, buckles or rattails.
5. More green compression strength added, less bond used.
6. Equalizes moisture in the heap.
7. Better flowability—less butting and tucking.

Try it!

Your tests will prove these statements to be correct.

You'll save money and have better results.

Additional data gladly sent upon request.

BENTONITE

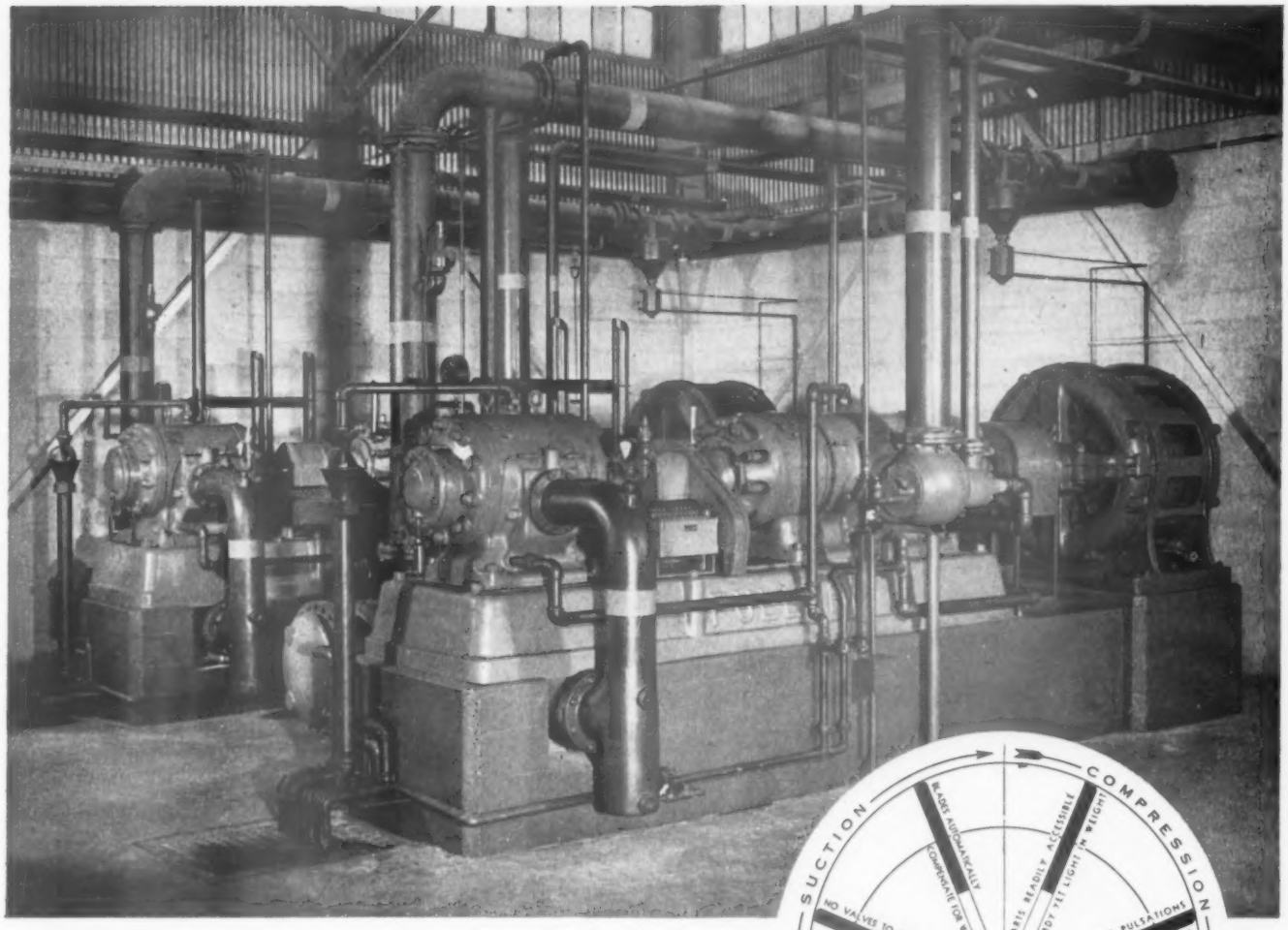
AT ITS BEST . . .

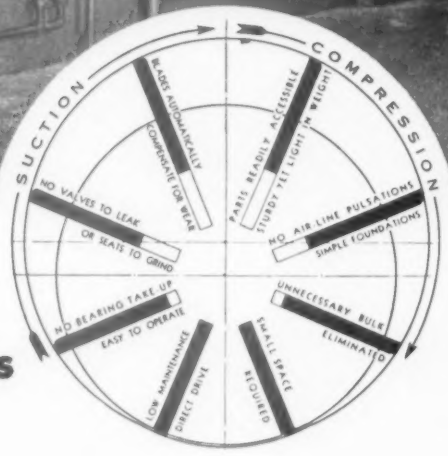
MERCHANDISE MART PLAZA • CHICAGO 54, ILLINOIS

VOLCLAY Western Bentonite • FIVE STAR Wood Flour • PANTHER CREEK Southern Bentonite

AMERICAN COLLOID COMPANY Chicago Illinois • Producers Since 1927

Available from Leading Foundry Suppliers in the United States and Canada





AIR ISN'T FREE!

but with FULLER rotary compressors IT NEED NOT BE COSTLY

Problem: To secure a dependable, economical source of air power for the cold-reduction sheet and tinplate mill of the Columbia Steel Co. at Pittsburg, Calif.

Solution: Two Fuller Two-Stage Rotary Compressors were installed. Each, driven by a 600-rpm. synchronous motor, delivers 1660 cfm. at 125 psig. Each is equipped with intercooler, regulator, and intake filter-silencer unit. In addition, complete full-magnetic electrical-control equipment is provided.

Fuller Rotary Compressors are built to provide a lifetime of new machine efficiency. They're sturdy, dependable—and because they have a minimum of moving parts—rotor, bearings and blades—they require minimum attention. There are no valves to leak, no seats to grind. Blades automatically compensate for wear. No detail has been overlooked that makes for long-term, trouble-free service at the lowest possible maintenance and operating costs.

Let a Fuller Engineer show you how they pay off in dependable service and long life.

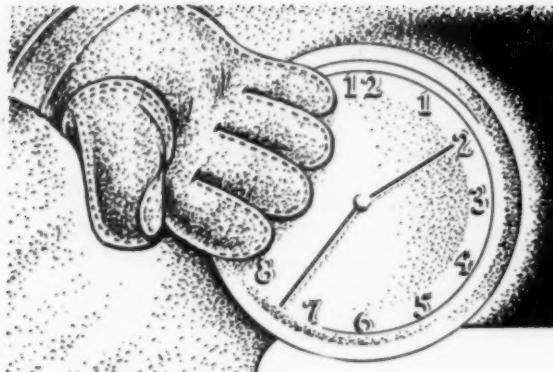
FULLER COMPANY, Catasauqua, Pa.

120 S. LaSalle St., Chicago 3 • 420 Chancery Bldg., San Francisco 4

fuller

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS
COMPRESSORS AND VACUUM PUMPS
FEEDERS AND ASSOCIATED EQUIPMENT

C-198



Cut Manual Handling Time

WITH *Light Weight*
PSC ANNEALING CONTAINERS

Because they weigh up to 2/3 less than cast containers, PSC welded alloy annealing units obviously handle much easier and faster. Let us show you how installations are effecting impressive savings in labor costs alone.

Left top, light-weight box with sand seal construction for bright annealing.
Left bottom, special basket for aircraft parts; movable sides and trays.
Right top, annealing tubes for steel mills. Only ¼" alloy; years of service.
Right bottom, combination annealing and pickling rack. Top braces removable.

In addition to the savings in handling time, PSC light-weight annealing containers effect four other substantial economies. First, being so much lighter in weight, they attain pot heat in less time; PSC installations have shortened heating cycles as much as 5 hours. Second, fuel savings; a recent study showed a $40 saving per anneal. Third, being less bulky, PSC units increase furnace capacity. Fourth, their much longer service life cuts replacement costs.

Standard and Special Types for Every Purpose

PSC welded alloy heat-treating equipment is furnished in any size, design or metal specification: annealing and carburizing boxes, covers, baskets, racks, tubes, retorts, etc. As a pioneer of welded alloy units, we offer a wealth of experienced engineering assistance. Send blue prints or write as to your needs.

THE PRESSED STEEL COMPANY
of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

☆ ☆ ☆ OFFICES IN PRINCIPAL CITIES ☆ ☆ ☆

CLOSE TOLERANCE CORE REPRODUCTION*

Photos courtesy of Union City Mold & Die Casting Co.

Above—workman is making a final check of the assembled dry sand tread core.

Right—grinding rim of the finished cast-to-size tire mold. Only additional finishing operation is polishing of the inner mold surface.

*More proof of the *Superior Qualities* of

CHATEAUGAY PIG IRON

CHATEAUGAY PIG IRON consistently accomplishes what other pig irons can't, and does it easily, economically.

Take the case of the tire mold maker who casts massive molds for big 10:00 x 20 truck and bus tires—molds that weigh 1057 pounds, and must perfectly reproduce sharp-edged, deep-grooved tread designs and detailed sidewall markings within .032" tolerance!

Due to the uniform shrinkage of wonder-working Chateaugay Pig Iron these molds are cast to size perfectly —and thanks to the close grain structure of Chateaugay Pig Iron only final polishing is needed after they leave the foundry. *Entirely eliminated is the extensive machining required on engraved tire molds!*

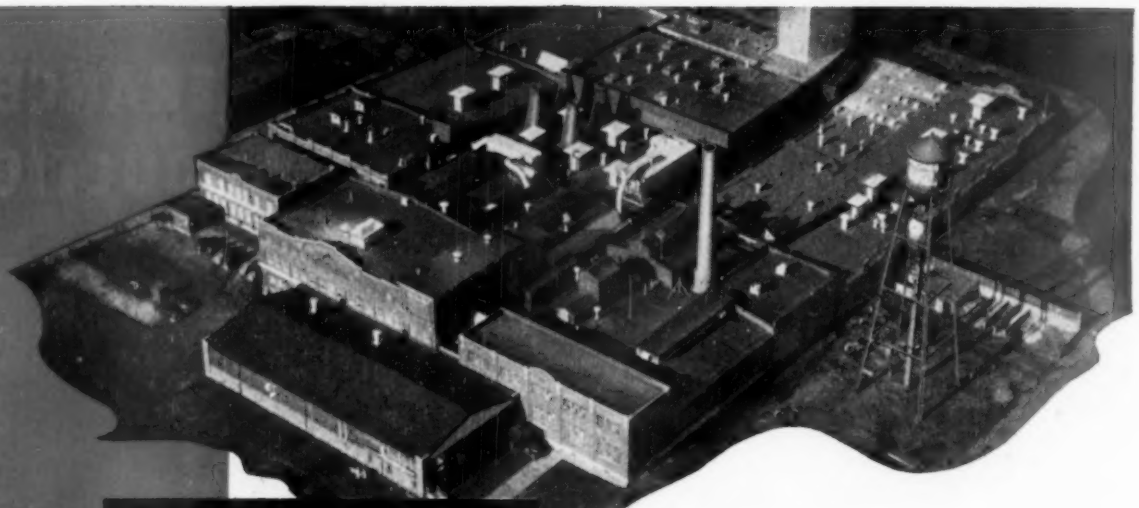
Low-phosphorus, copper-free Chateaugay Pig Iron offers *many* cost-saving advantages . . . provides unsurpassed casting and finishing characteristics. A Republic Pig Iron Metallurgist will be glad to give you all the facts about Chateaugay Pig Iron without cost or obligation on your part. Just let us know when you would like him to call.

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

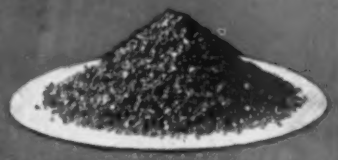
Republic **PIG IRON**

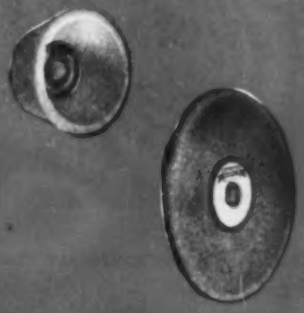
"CHATEAUGAY"	"REPUBLIC"	"PIONEER"
Low-Phosphorus, Copper-Free	(Northern) Foundry, Basic and Malleable	(Southern) Foundry and Basic

REPUBLIC STEEL



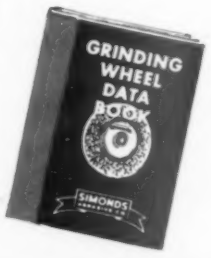
SIMONDS
ABRASIVE CO.





Everything from grains to grinding wheels

Everything from the most minutely screened abrasive grain to rugged giant sized grinding wheels. They're yours in Simonds Abrasive Company's complete line — manufactured under complete Simonds control for consistently dependable performance — backed by an engineering service to help you solve troublesome grinding problems — and supplied through a distributor set-up geared to meet every grinding need including rough snagging, precision finishing, metal polishing . . . for production operations and maintenance use.



Write for Grinding Wheel Data book, your handy guide on how to select and use Simonds Abrasive Company Grinding wheels.

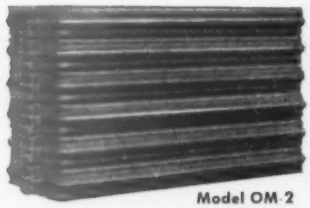
SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA., DISTRIBUTORS IN PRINCIPAL CITIES

DIVISION OF SIMONDS SAW AND STEEL CO., FITCHBURG, MASS. OTHER SIMONDS COMPANIES: SIMONDS STEEL MILLS, LOCKPORT, N.Y., SIMONDS CANADA SAW CO., LTD., MONTREAL, QUE. AND SIMONDS CANADA ABRASIVE CO., LTD., ARVIDA, QUE.

"We need one-man flasks"

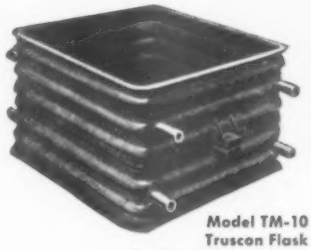
Model OM-1
Truscon Flask
for One-Man Handling.

Model OM-4
Truscon Flask
for One-Man Handling.



Model OM-2
Truscon Flask
for One-Man Handling

"We need two-man flasks"

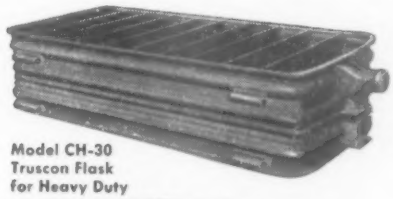


Model TM-10
Truscon Flask
for Two-Man Handling

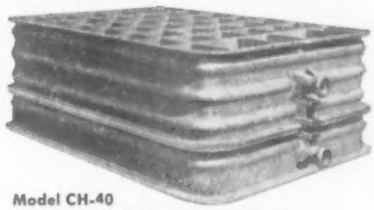
Model TM-11
Truscon Flask
for Two-Man Handling.

Model TM-12
Truscon Flask
for Two-Man Handling

"We need crane flasks"



Model CH-30
Truscon Flask
for Heavy Duty



Model CH-40
Truscon Flask for Extra Heavy Duty.

Model CH-20
Truscon Power Handled Flask.

Truscon supplies them all!

Over 20 years of experience in flask engineering and production has given Truscon a know-how that is outstanding in the industry.

Exceptional strength and rigidity are built into Truscon Steel Flask walls.

The ribs and flanges extend full depth around the entire flask without buckling or cutting away the metal. The flange on the filling side is turned out so it will not interfere with filling or shaking out. The flange on the bottom side or parting line is turned in, forming a sand strip to carry the sand.

A wide range of welded handles and pin lugs is available. Every Truscon cope, drag and check is one integral piece of steel.

Write for catalog showing the wide range of Truscon Steel Flasks that can be manufactured.

TRUSCON
MARK OF MERIT PRODUCTS

TRUSCON STEEL COMPANY

PRESSED STEEL DIVISION • 6202 TRUSCON AVENUE • CLEVELAND 4, OHIO
SUBSIDIARY OF REPUBLIC STEEL CORPORATION

LOWE Electric Sifter

A high quality sifter featuring greate screening area, enclosed ball bearin motor, more shoveling room, rugged con struction and trouble-free operatio Saves time and money through faster sif ing and better sand conditioning.

buy FEDERAL

Because the type and condition of your equipment directly affect (1) production rate and costs, (2) maintenance costs, (3) quality of product and (4) profit—the selection of equipment becomes an all-important move. It is extremely vital to the successful operation of your foundry that you use only the most modern, most efficient machines. So, when you're ready to buy equipment, make the right move—buy FEDERAL—across the board.

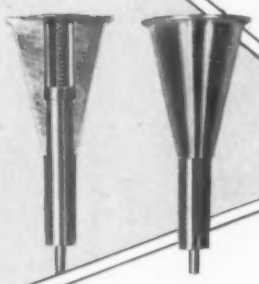
Shown here are only a few of the more than 400 items that go to make up the FEDERAL line—FEDERAL-made products that foundrymen everywhere have been using profitably for years. Call your local FEDERAL representative or write or wire for full information and prices.

FEDERAL FOUNDRY manufactures all equipment illustrated.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

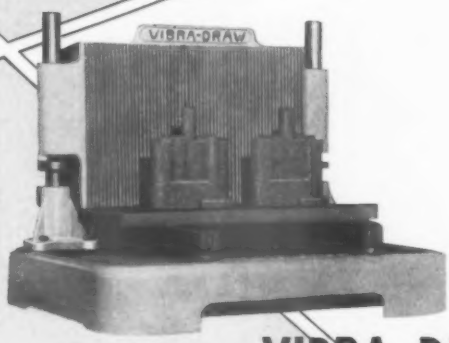
MAKE THE RIGHT MOVE

when you buy equipment...



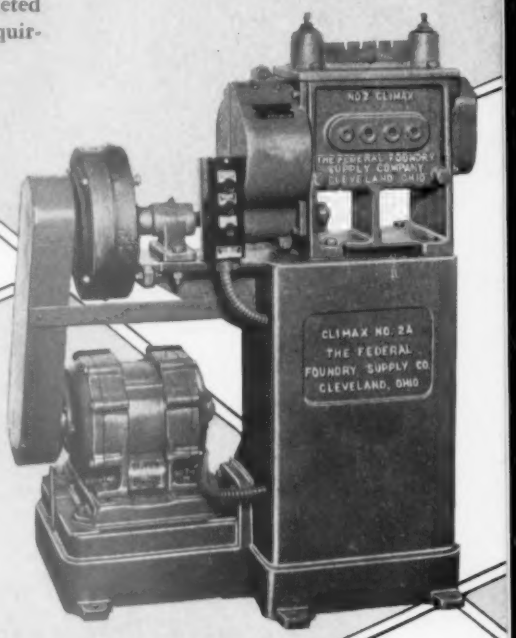
SHUR-SPOT SPRUES

For squeezer-made molds. SHUR-SPOT squeezes down with the sand. When squeezer board is removed, SHUR-SPOT pops up to be lifted out. The result is a fully completed and properly located pouring sprue, requiring no finishing.



VIBRA-DRAW

With any core blower, you make cores only as fast as you draw them. VIBRA-DRAW draws cores as fast as SAN-BLO makes them. Simply place core box against vibrating head and lift box. A perfect core every draw—and fast!

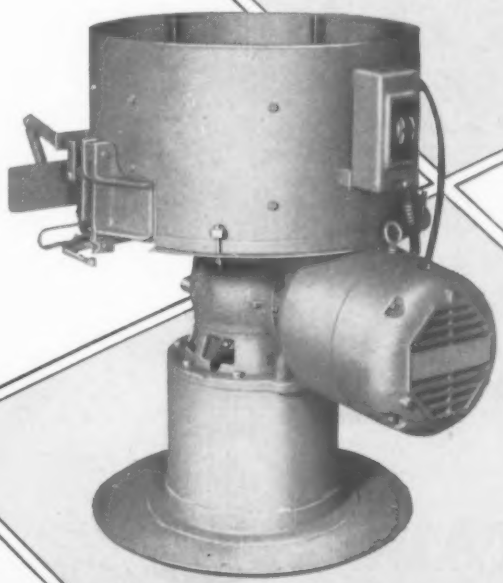


CLIMAX Wire Straightener

Wire is hard to get, so it's important that you straighten and re-use wires and rods. The CLIMAX, an old friend in many foundries, is the ideal machine for this job. Handles random lengths. Operated efficiently by unskilled labor. Wide variety of models.

SAN-BLO

The first all-purpose sand blower. Motor driven plows move sand in blow head to conserve full air pressure for aerating and carrying sand into core box. Blows any sand you can hand-ram, regardless of bond strength or moisture. Blows single cores up to 40 lbs. each, or 40 lbs. of small cores, without refilling blow head. Any type box. One blow plate, one universal vent plate. The fastest, most efficient sand blower ever developed. Ideal for jobbing foundries.



WHIRLMIX Sand Mixer

The first and only mixer with flexible, whirling, rubbing arms. Produces fluffy, aerated, thoroughly mixed sand without overheating, or crushing sand grains. Small, compact, easily moved—yet a big producer, for it mixes 4,000 lbs. of sand per hour.

The FEDERAL FOUNDRY SUPPLY Company

4600 EAST 71st STREET · CLEVELAND 5, OHIO

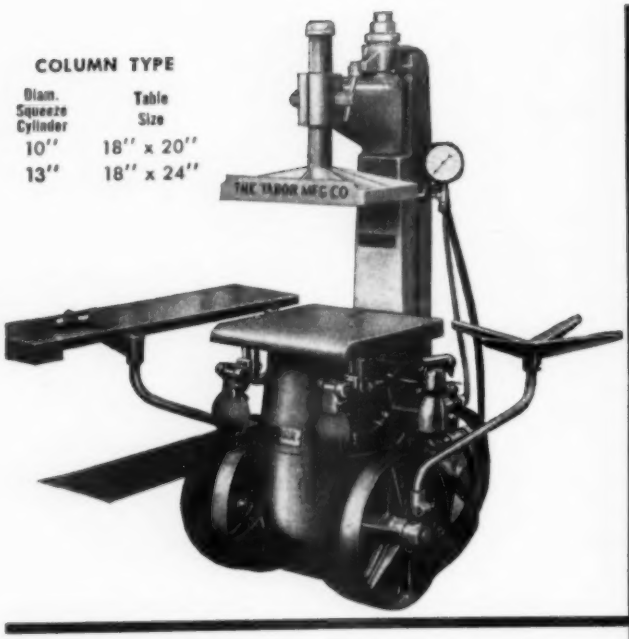
CHICAGO DETROIT MILWAUKEE

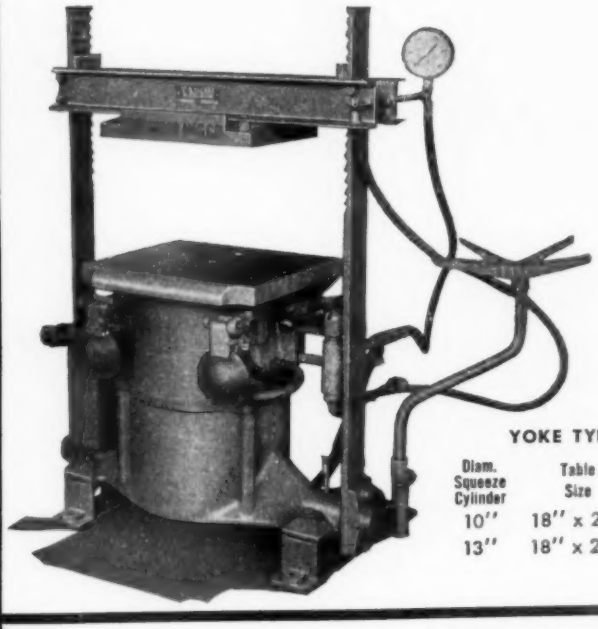
NEW YORK CHATTANOOGA RICHMOND, VA. LOS ANGELES

There's a Tabor Squeezer to fit the job!

COLUMN TYPE

Diam. Squeeze Cylinder	Table Size
10"	18" x 20"
13"	18" x 24"





YOKE TYPE

Diam. Squeeze Cylinder	Table Size	Space Between Uprights
10"	18" x 20"	32"
13"	18" x 24"	36"

TOP-SQUEEZE TYPE

Diam. Squeeze Cylinder	Table Size
10"	16" x 19"

(Also available in portable or portable sand-straddler types)

CANTILEVER TYPE

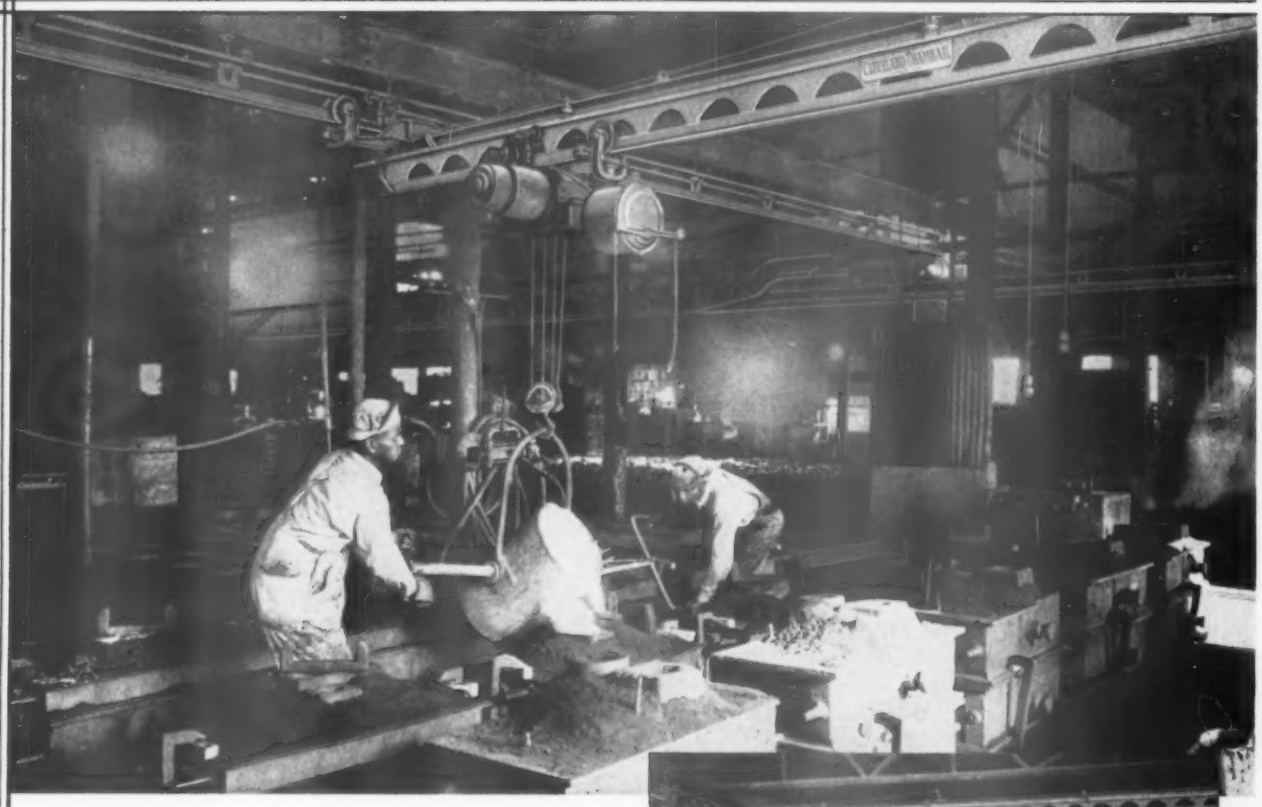
Diam. Squeeze Cylinder	Table Size
10"	18" x 20"
13"	18" x 24"

The **TABOR** *Manufacturing Co.*

SINCE **1884** MANUFACTURERS OF FOUNDRY MOLDING MACHINES

6225 TACONY STREET • PHILADELPHIA 35, PENNA.

from LIGHT *to* HEAVY *Production Overnight*



Texas Foundry Revolutionized with CLEVELAND TRAMRAIL

Before the advent of Cleveland Tramrail the Trinity Valley Iron and Steel Company, a gray iron jobbing foundry in Ft. Worth, Texas, was limited to the production of small castings because their flasks, molds, cores and ladles could be no larger or heavier than readily handled by hand, except in the main bay of the shop.

Practically overnight this concern was revolutionized by installation of a Cleveland Tramrail system. It took them out of the small casting class; they now can pour castings of any size, from the smallest to the largest. It cut drastically the time required for handling materials and thereby boosted efficiency greatly. It reduced metal heat loss because conveying time from cupola to mold is less via the Tramrail route. Safety has been aided.

The Cleveland Tramrail system at Trinity Foundry consists of many bridges, hoist carriers, switches and extensive trackage which provides overhead handling service for nearly the entire floor area.

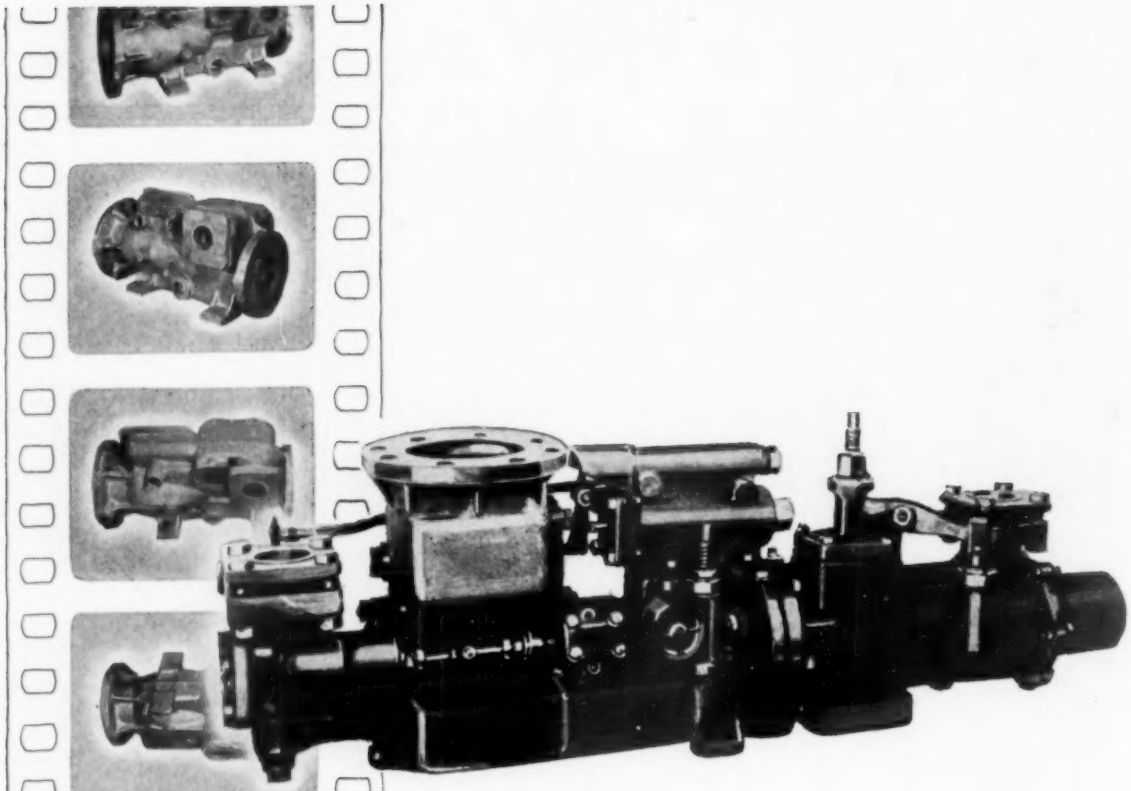
Trinity is now in such a favorable position that it is serving customers over a wide radius, some more than 1000 miles distant. It is doing so expeditiously, with better castings at lower cost.

GET THIS BOOK!

BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
3816 EAST 286TH ST. WICKLIFFE, OHIO

CLEVELAND TRAMRAIL
OVERHEAD MATERIALS HANDLING EQUIPMENT



Exhaust Steam Injector Body
Courtesy Combustion Engineering-Superheater Inc.

to be sure

COMBUSTION-SUPERHEATER uses FEDERATED BRONZE INGOT

When a difficult bronze casting problem faced Combustion Engineering-Superheater Inc., they turned to Federated Metals and the Christensen and Olsen Foundry in Chicago.

C & O and Federated solved the problem. The castings...parts of an Exhaust Steam Injector Body which must be pressure tight and virtually perfect...are made by C & O. Federated copper-base alloys are used because metal of consistent quality is demanded.

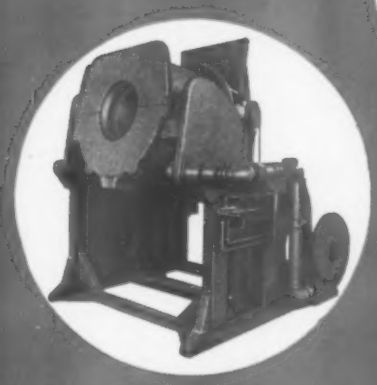
Federated metals and Federated service are at your command, too, whenever you have a foundry problem.

See Federated first for any non-ferrous alloy...aluminum, magnesium and copper-base foundry metals; solders; bearing metals; and fabricated lead products.

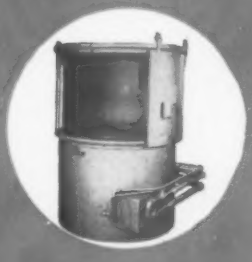
Federated Metals Division

federated first in the non ferrous field FMD

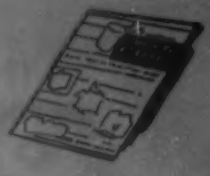
AMERICAN SMELTING AND REFINING COMPANY • 120 BROADWAY, NEW YORK 5, N. Y.



MELTING AND HOLDING FURNACES



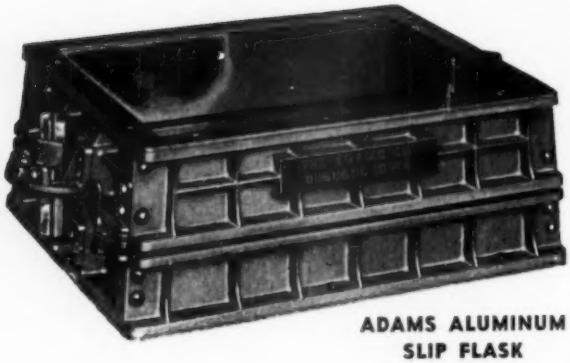
Lindberg-Fisher builds all kinds of melting and holding equipment . . . gas . . . oil . . . electric . . . induction . . . arc and high frequency. Lindberg-Fisher engineers can intelligently and without prejudice recommend the proper type of furnace to best suit your needs and conditions.



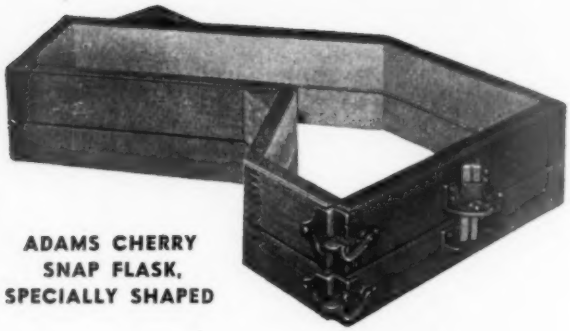
Bulletin 551 covers the complete melting line. Write for your copy today.

LINDBERG-Fisher A DIVISION OF LINDBERG ENGINEERING CO.

2453 WEST HUBBARD STREET · CHICAGO 12, ILLINOIS



ADAMS ALUMINUM
SLIP FLASK



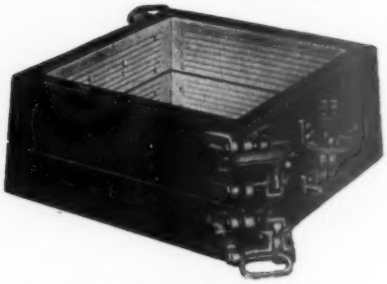
ADAMS CHERRY
SNAP FLASK,
SPECIALLY SHAPED

Any Shape—Any Size

FLASKS OR FLASK EQUIPMENT

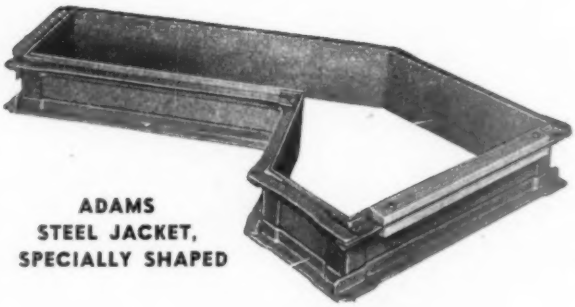
ADAMS-BUILT

To Your Exact Specifications

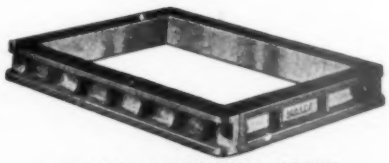


ADAMS CHERRY
EASY-OFF FLASK

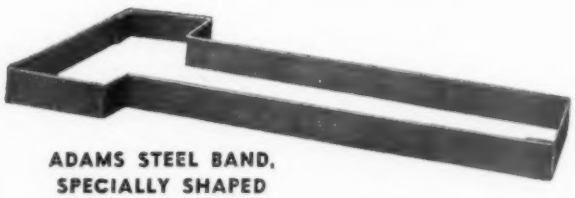
Whatever style, size or shape you need, Adams Custom made Flasks and Flask Equipment are built to your order, with any desired length, width or depth, by men who *know* foundry requirements. And when they are *Adams-Built,* they assure more efficient performance, longer life and faster production. They are designed to maintain peak production of high-quality castings, reduce rejects, lower production costs. It is hard to surpass Adams Flasks for accuracy, convenience and economy. Write for complete information today.



ADAMS
STEEL JACKET,
SPECIALLY SHAPED



ADAMS ALUMINUM UPSET



ADAMS STEEL BAND,
SPECIALLY SHAPED

THE ADAMS COMPANY
800 FOSTER ST. DUBUQUE, IOWA

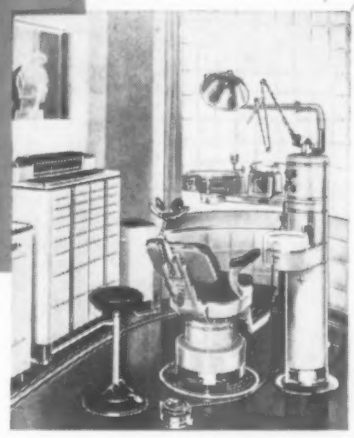
The ADAMS Company

ESTABLISHED 1883

DUBUQUE, IOWA, U.S.A.

MOLDING MACHINES and FLASK EQUIPMENT

HOW MANY CASTINGS in a DENTIST'S EQUIPMENT?



S.S.WHITE makes 'em all with DETROIT ROCKING ELECTRIC FURNACE melts

S. S. White Dental Manufacturing Company, in its Staten Island plant, makes everything a dentist needs. A great many castings go into the making of chairs, tables, control and operating equipment.

Type LFC Detroit Rocking Electric Furnace. Capacity 350 lbs., melting nickel alloy iron.

All metal used in this wide variety of precise castings is melted in Detroit Rocking Electric Furnaces.

Read the Advantages !

Here are the advantages that Detroit Electrics deliver at S. S. White: Better control of analysis. Smoother surface finish—important because many of the castings are enamelled or chrome plated. Accurate temperature control. Added gains are cleaner operation, improved working conditions, and savings in floor space.

You, too, may well profit from Detroit Rocking Electric Furnaces. You can get better castings, fewer rejects, higher usable yields, faster melts. Electrodes are always clear of the molten bath, eliminating carbon pickup. Indirect arc and automatic electrode adjustment assure optimum power use.

Linings of these great furnaces last longer. Replacement linings, when necessary, are quickly installed.

Get the Facts

For ferrous or non-ferrous metal melting, Detroit Rocking Electric Furnaces have much to offer you. Send us your production data. Our engineers will give you the facts on the benefits that can be yours.

Capacities from 10 to 4000 lbs. Conical or cylindrical chambers.

WRITE TODAY!

DETROIT ELECTRIC FURNACE DIVISION

KUHLMAN ELECTRIC COMPANY • BAY CITY, MICHIGAN

Foreign Representatives: In BRAZIL—Equipamentos Industrias "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Casco, S. de R. L. Atenas 32, Despacho 14, Mexico City, D. F.

By Installing CURTIS Air Compressors, Air-Operated Cylinders and Hoists

Plants Everywhere

- Save manhours
- Reduce production costs
- Increase plant efficiency

No better equipment is built for producing air at low cost, or for assuring efficiency in any lifting, pulling or pushing operation.

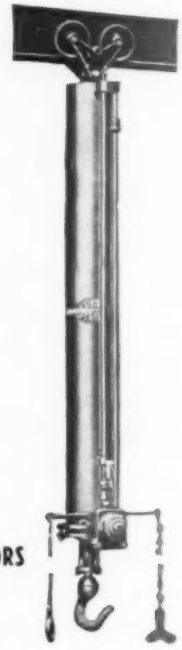
Precision built by a company with 96 Years of "Know-How"—Your assurance of proper performance from the moment of installation.

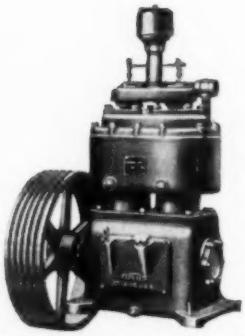
MODEL F AIR COMPRESSORS

- Timken-Bearing Equipped
- Self-Lubricating
- Centrifugal Unloaded Starting
- Nationally-Known Motor

CURTIS AIR HOIST

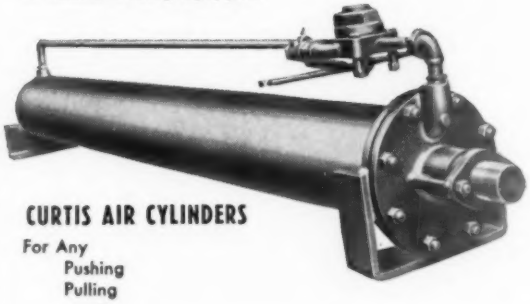
- Accurate Finger-Tip Spotting of Loads
- Low-Cost Lifting





CURTIS MODEL C AIR COMPRESSORS

- Water-Cooled
- Up to 50 H.P.
- Fully Enclosed
- Dust and Dirt-proof
- Timken-Bearing Equipped



CURTIS AIR CYLINDERS

For Any
Pushing
Pulling
or
Lifting Operation

CURTIS PNEUMATIC MACHINERY DIVISION
of Curtis Manufacturing Company
1922 Kienlen Avenue St. Louis 20, Mo.

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150-2

CURTIS PNEUMATIC MACHINERY DIVISION
of Curtis Manufacturing Company
1922 Kienlen Avenue, St. Louis 20, Mo.

I am interested in items checked below:

☐ Air Hoists
☐ Air Cylinders
☐ Air Compressors

NAME.....
FIRM.....
STREET.....
CITY.....ZONE....STATE.....

Bulletin on SUPER REFRACTORIES

by CARBORUNDUM
TRADE MARK

NO. 12 DECEMBER, 1950

How Can You be Sure of Proper Selection of Super Refractories?

The table below shows that the line of super refractories offered by The Carborundum Company includes several distinct product groups. Each has specialized characteristics — equally important in both high- and low-temperature applications. Beyond these basic groups, however, are many modified varieties, each developed to better withstand a particular combination of conditions. Consequently, the selection of the best possible material for a given installation becomes involved.

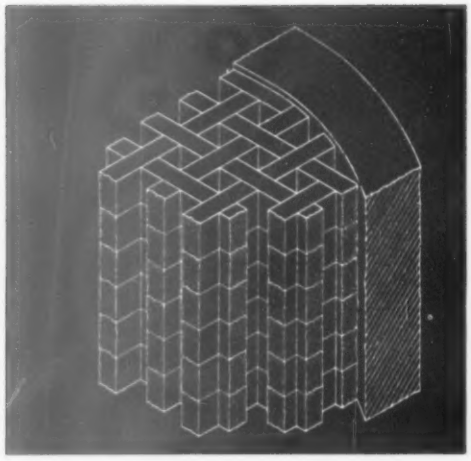
It is for this reason that you should have no hesitation in asking for the assistance of CARBORUNDUM field engineers. These men have had wide experience with super refractories and their application to many different types of furnaces and kilns.

Supporting the work of these field engineers is CARBORUNDUM'S technical group. Not only is this group close to both manufacturing operations and research programs — they are also in touch with developments throughout the world involving new processes using super refractories. These men have the broad product and application knowledge that is most helpful in considering unusual new installations.

You can be sure of getting the right super refractory for your job when you bring your problem to CARBORUNDUM.

Physical Properties of Super Refractories by CARBORUNDUM
Trade Mark

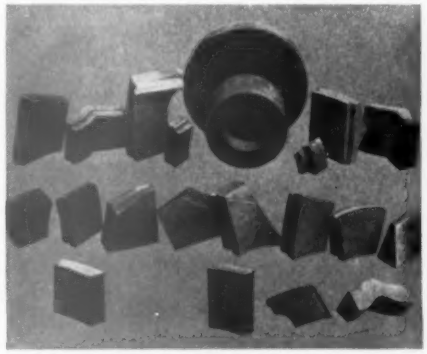
	CARBOFRAX Silicon Carbide	MULLFRAX Electric Furnace Mullite	MULLFRAX S Converted Kyanite	ALFRAX K Electrically Fused Alumina	ALFRAX B Electrically Fused Alumina	ALFRAX BI Electrically Fused Alumina
Heat Conductivity at 2200° F. in BTU/ hr. sq. ft. and °F. /in. of thickness	109 BTU	16 BTU	9 BTU	24 BTU	12 BTU	7 BTU
REFRACTORINESS PCE CONE	37-40	38-39	37-38	37-39	39-40	38-39
SPALLING RESISTANCE	High	High	High	Good	Good	Good
ABRASION RESISTANCE	High	Medium	Medium	High	Medium	Low
THERMAL EXPANSION (25° — 1400° C.)	.0000044	.0000059	.0000069	.0000074	.0000086	.0000086
MODULUS OF RUPTURE @ 2460° F. PSI	800-3125	100-250	175-475	100-1050	100-225	50-100
WEIGHT 9 IN. STRAIGHT	9.25 lbs.	9 lbs.	8 lbs.	10.1 lbs.	7.25 lbs.	4.8 lbs.



Proper Use of CARBOFRAX Checkers Can Increase Gas-Make

With CARBOFRAX silicon carbide checker brick properly applied in carburetors, superheaters, and oil-gas generators by CARBORUNDUM field engineers, operators can increase their gas-make and lower their operating costs. CARBOFRAX checkers, because of their high thermal conductivity and high emissivity, absorb more heat in less time. For the same reasons the heat is released to the gas stream more rapidly during regeneration.

With their unusual refractoriness, great density and low iron content, CARBOFRAX brick last longer and provide cleaner checker settings. In other words — with CARBOFRAX brick you get better oil efficiency, increased cracking capacity, lower checker maintenance, and savings in the solid fuel.



Jig-saw — of CARBOFRAX Shapes!

These are some of the pieces that made up a refractory lining designed by CARBORUNDUM engineers for a metallurgical process. In all, there were several thousand pieces — and about 1000 of them were of different keyed, fitted shapes.

The problem was to furnish a lining that molten metal would not penetrate, that could withstand rapidly fluctuating

"Carborundum," "Carbofrax," "Mullfrax," "Silfrax," "Alfrax" are registered trademarks which indicate manufacture by The Carborundum Company

Address all correspondence to: Dept. A-120, THE CARBORUNDUM COMPANY, Refractories Division, Perth Amboy, New Jersey

Continued on other side →

← Continued from other side

pressures, and that would perform under unusually high temperatures. CARBOFRAX silicon carbide tile was the answer — in special and intricate shapes which would fit the complicated shell. With elbows and bends, every piece had to be keyed to fit, with accurate tight joints — and the completed lining mechanically stable.

The result? An amazing performance record, far surpassing any previous lining — more proof of what the correct grade of CARBOFRAX materials will do when engineered to the job.

Kiln Furniture Designed by CARBORUNDUM Engineers Improves Performance

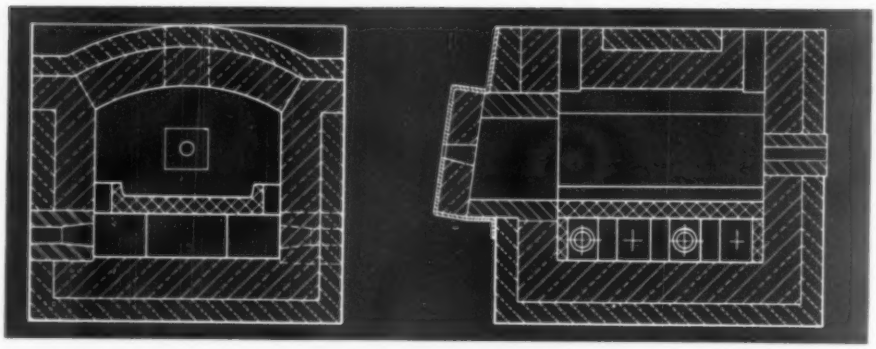
These are the advantages a sanitaryware producer reports from using CARBOFRAX silicon carbide tile and CARBOFRAX streamlined posts in this car structure laid out by CARBORUNDUM engineers:

Greater loading capacity — With thin CARBOFRAX slabs and streamlined posts, there is more space for setting ware. Placing, too, is easier.

Fewer rejects — The clean CARBOFRAX kiln furniture prevents ware marking. Even after long service, there is no dripping and blistering.

Less frequent rebuilds — With CARBOFRAX furniture, cracking and warping are practically eliminated. Post deformation is no problem. Replacement and maintenance expenses are reduced to a minimum.

The properties of CARBOFRAX tile and posts make them unique for such applications. With their high hot strength, they can support heavy loads without sagging. With their exceptional resistance to heat shock, they will not crack prematurely. Their high thermal conductivity means quick, uniform heat transfer. All in all, they will increase production and lower costs.



Small Oven Furnaces — Perform Better When Super Refractories Are Properly Used

Increased production and operating economies almost always follow the installation of a CARBOFRAX hearth in a small oven furnace. The high thermal conductivity of this super refractory means rapid heat transfer, with quicker temperature come-back after charging, and more uniform heat distribution throughout the chamber. With cold spots eliminated, there are fewer rejects. Maintenance expense, too, is cut — with its high resistance to mechanical abrasion, and to cracking, a CARBOFRAX hearth lasts longer.

However, super refractories have even more possibilities in such furnaces. CARBOFRAX silicon carbide or MULLFRAX electric-furnace mullite supports last longer and improve quality of work by keeping the floor flat and level. Burner ports and door blocks of MULLFRAX S converted kyanite blocks promote more continuous operation, reduce maintenance. Even main linings will last longer — and improve furnace efficiency — when partially or entirely constructed of ALFRAX BI aluminum oxide brick or shapes.

For Melting Furnaces, Too Let CARBORUNDUM Engineers Select Your Lining

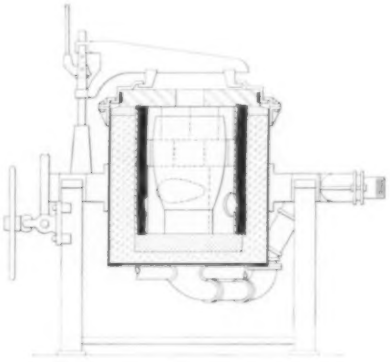
Non-ferrous metal melting furnaces, such as shown in the drawing at right, almost invariably give better results when properly lined with CARBOFRAX silicon carbide shapes:

Lining costs come down — With their high resistance to spalling, cracking and flame erosion, CARBOFRAX linings last longer. Lining costs are lower per pound of metal melted.

Production goes up — CARBOFRAX linings need be only 1¾-inches thick. Consequently heavier insulation can be used — and the heat capacity of the furnace structure will be lower. Melting rates are faster; you can get more heats per shift.

Maintenance costs are reduced — Not only do CARBOFRAX linings last longer, but when replacement is finally necessary, it can be made easily and quickly. The individual CARBOFRAX tile are accurate in size, and have rugged interlocking joints. Frequent patching can be avoided, too — saving further on labor costs.

CARBOFRAX linings are stocked in a wide variety of sizes. Special sizes can be produced quickly to order.



To obtain facts and figures on installations in specific fields merely select from this list of bulletins. Copies will be sent you at once. No obligation, of course.

Super Refractories by CARBORUNDUM (general catalog)

Super Refractories for the Ceramic Industry

Super Refractories for the Process Industry

Super Refractories for Boiler Furnaces

Super Refractories for Heat Treatment Furnaces

Super Refractories for Gas Generators

The Frax Line of Cements

CARBOFRAX Refractory Skid Rails

Porous Media for Filtration & Diffusion

Dept. No. A-120

THE CARBORUNDUM COMPANY

Refractories Division

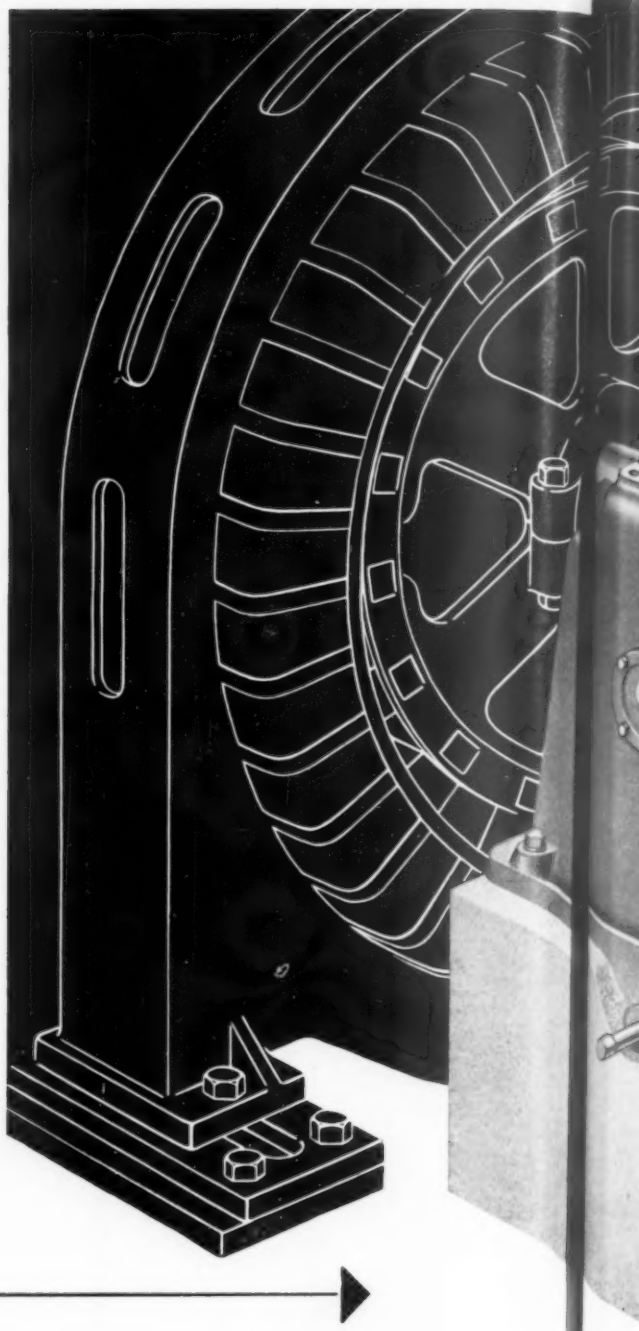
PERTH AMBOY, NEW JERSEY

...always a fast, even heat
...like INTERNATIONAL GRAPHITE ELECTRODES

International GRAPHITE AND ELECTRODE CORP.
ST. MARYS, PA.

6261

FIRST with roller bearings THROUGHOUT



IN A HORIZONTAL DUPLEX COMPRESSOR

- SPHERICAL ROLLER MAIN BEARINGS
- SPHERICAL ROLLER CRANKPIN BEARINGS
- HEAVY-DUTY NEEDLE BEARINGS AT CROSSHEAD

Chicago Pneumatic's Class O-CE AIR COMPRESSORS are the first horizontal duplex, side crank compressors to have anti-friction roller bearings throughout . . . spherical roller main and crankpin bearings . . . heavy-duty needle bearings at the crosshead pins.

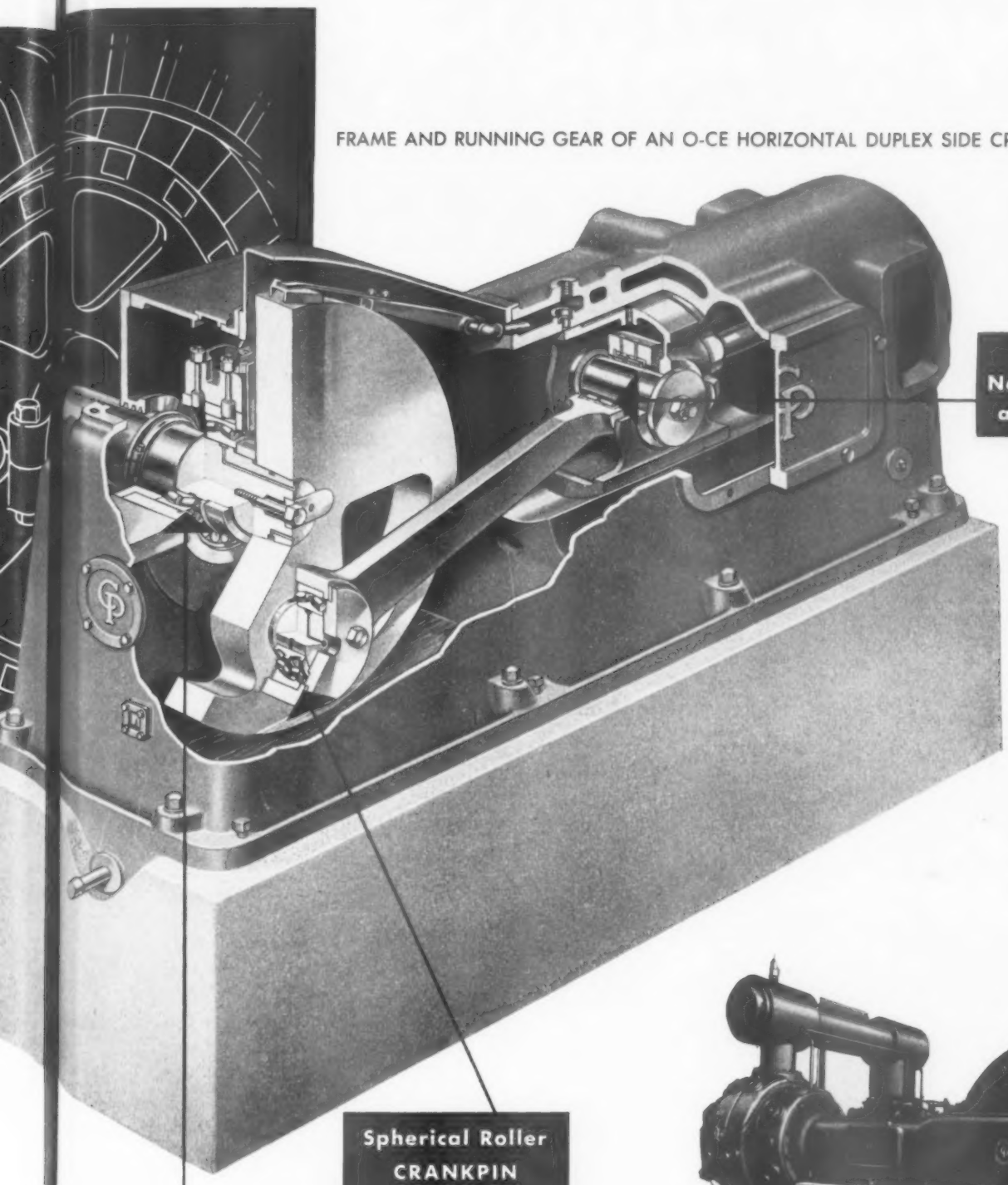
To the user, "roller bearings throughout" means easier and cheaper maintenance, and no possibility of improper bearing adjustment with resultant serious damage to frame and running gear.

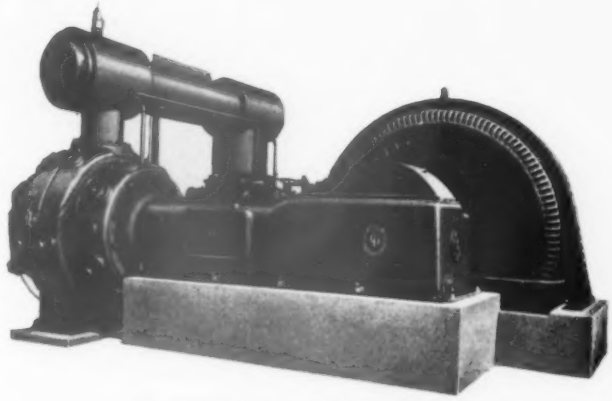
Roller crankpin bearings permit the use of solid-end connecting rods—the strongest, safest type.

This revolutionary innovation is made possible by the recent development of the oil injection method of bearing and crank disc installation and removal. This simple method, requiring only a hand-operated oil pump and ordinary hand tools, is employed also for the application or removal of gears, couplings and sleeves on shaft ends.

Class O-CE Motor-driven Compressors are furnished in sizes up to 2000 h.p.

FRAME AND RUNNING GEAR OF AN O-CE HORIZONTAL DUPLEX SIDE CRANK COMPRESSOR





CLASS O-CE TWO-STAGE MOTOR-DRIVEN COMPRESSOR

Write for Bulletin 726-5

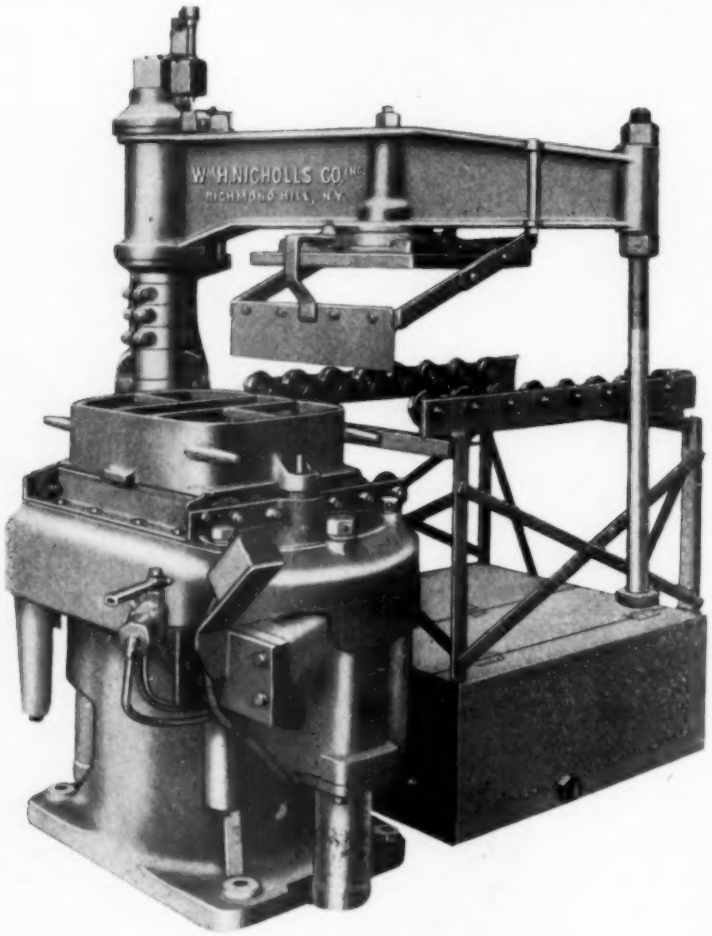
CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

IMPROVED
HEAVY-DUTY MOLDING MACHINES

COMBINATION JOLT & POWER SQUEEZERS WITH PNEUMATIC PATTERN DRAW AND POWER OPERATED, PARALLEL, SELF POSITIONING SQUEEZE HEAD, AND EQUIPPED WITH ELECTRICAL CONTROLS FOR SINGLE BUTTON AUTOMATIC OPERATION



14-36 TYPE "D"

Heavy Duty Combination Jolt & Power Squeezer Molding Machine with pneumatic pattern draw and power operated self positioning parallel squeeze head. Equipped with electrical controls for single button automatic operation of Jolt, Squeeze, Pattern Draw and Cross-arm. Including Automatic Sand Strike-off, Mold Pusher & Adjustable Flask Rolloff Device.

Also larger size machines now equipped with electrical controls for automatic operation. Nicholls builds a complete line of Molding Machines comprising stationary and portable types for the production of light, medium and heavy castings. Descriptive literature available for each type.

Wm. H. NICHOLLS Co., Inc.
RICHMOND HILL, LONG ISLAND, NEW YORK

Foreign Manufacturers and Selling Agents—
For Continental Europe and Great Britain—The George Fischer Steel and Iron Works, Schaffhausen, Switzerland

NICHOLLS

New sand conditioner on TIMKEN® bearings keeps sand in shape four ways

HERE'S a sand conditioner that keeps foundry sand in prime condition by cutting, separating, screening and piling—all in one operation. It's the new Sandmaster, manufactured by the American Wheelabrator & Equipment Company of Mishawaka, Indiana.

Because a fast, mobile conditioner that can stay on the job is essential to efficient foundry production, the Sandmaster's four wheels are mounted on Timken® tapered roller bearings. Timken bearings not only insure long, trouble-free performance, but they keep the Sandmaster rolling.

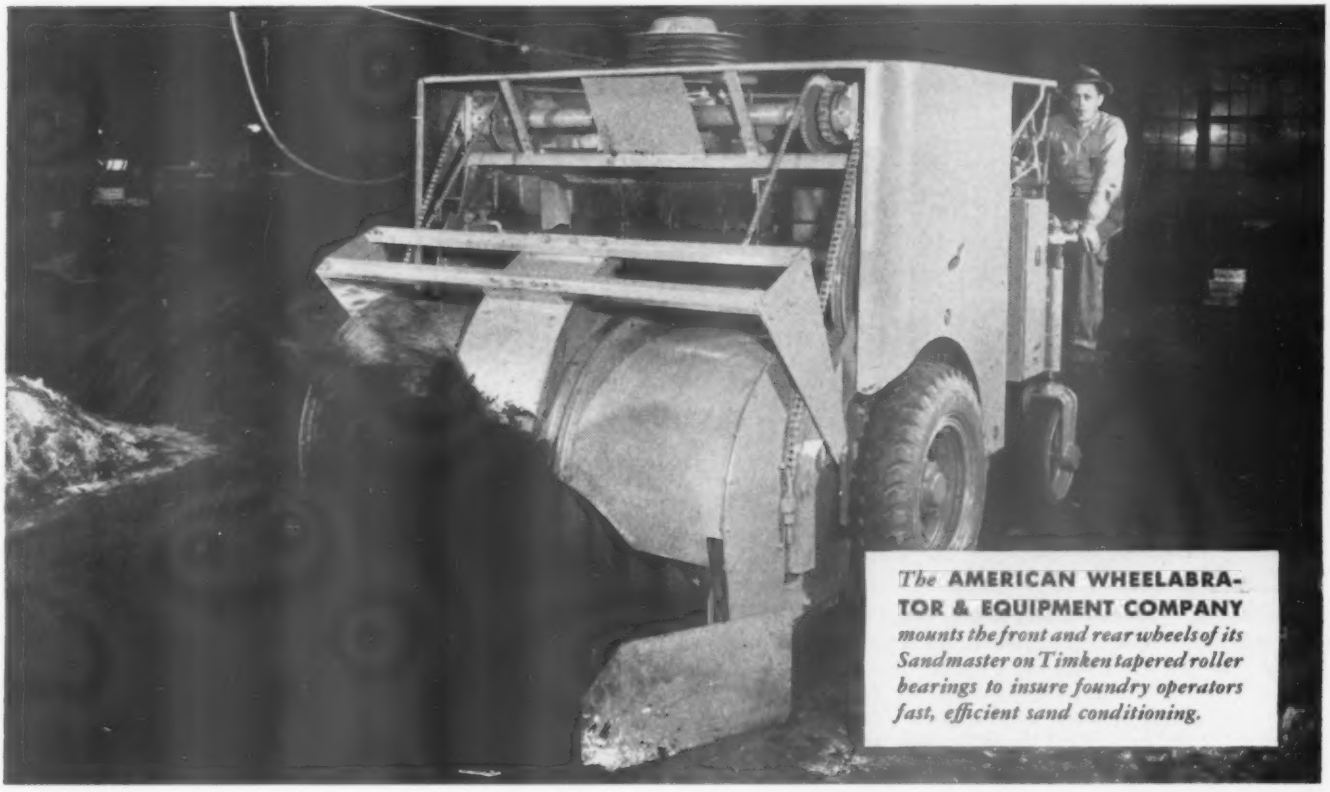
Timken bearings have extra load-carrying capacity, too, due to line contact between rollers and races. Tapered construction enables them to take any combination of radial and thrust loads. Wheels are held in perfect alignment. Timken bearings' true rolling motion and incredibly smooth surface finish practically eliminate friction. As a result, wear on moving parts is negligible.

Timken bearings permit tighter closures that keep lubricants in—damaging sand and grit out. No valuable production time is lost due to bearing breakdowns. Maintenance time and material costs are held to a minimum.

Under normal usage, Timken bearings will last the life of the machine. That's because they are (1) carefully engineered for the job, (2) made of Timken fine alloy steel, and (3) precision manufactured.

For over half a century, the outstanding performance of Timken bearings has made them first choice throughout industry. And you can get *all* the advantages Timken bearings give by insisting on them in the equipment you buy, and mounting them in the machines you build. Always look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

This symbol on a product means its bearings are the best.



The **AMERICAN WHEELABRATOR & EQUIPMENT COMPANY** *mounts the front and rear wheels of its Sandmaster on Timken tapered roller bearings to insure foundry operators fast, efficient sand conditioning.*

FINISHED TO CLOSER TOLERANCES

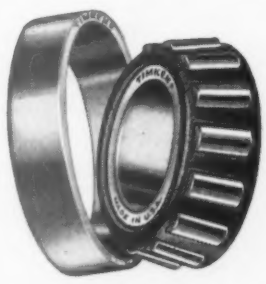
Finishing to incredible smoothness accounts for much of the precise, smooth rolling performance of Timken bearings. This honing operation is typical of the amazingly accurate manufacturing methods at Timken.

The Timken Company is the acknowledged leader in: 1. advanced design; 2. precision manufacturing; 3. rigid quality control; 4. special analysis steels.

TIMKEN

TRADE-MARK REG. U.S. PAT. OFF.

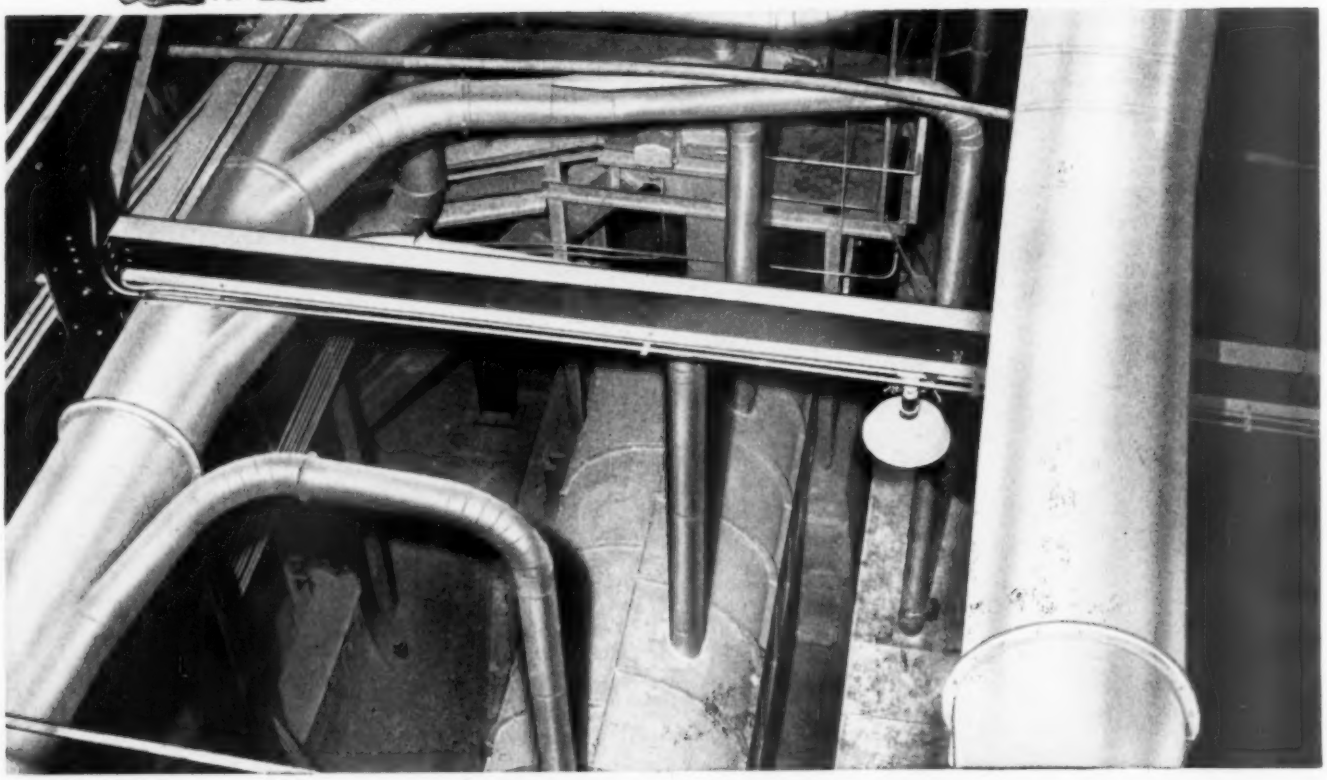
TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⊂ THE TIMKEN TAPERED ROLLER ⊂ BEARING TAKES RADIAL ◁ AND THRUST ▷ LOADS OR ANY COMBINATION

Dust takes the easy way out!

...through a Kirk & Blum Dust Control System



Dust Control System on Rotary Breaker Screen and sand handling system in a casting plant of one of the nation's largest steel companies.

The large volumes of dust produced in the sand handling operations of this plant are not a problem. As soon as dust is formed, it is removed by the KIRK & BLUM Dust Control System.

One of the many KIRK & BLUM foundry installations, this Dust Control System meets every requirement of the American Foundrymen's Association code; heavy gauge piping has flanged joints and convenient clean-out doors.

Hundreds of plants, large and small, have found it pays in *greater operating efficiency* to have a dust or fume control system designed and installed by experts. For all three—design, fabrication and installation—call on KIRK & BLUM.

If you need a new dust control system . . . or more capacity in an existing one, contact KIRK & BLUM. They'll gladly prove the money-saving efficiency of systems by KIRK & BLUM, specialists in dust and fume control for more than 43 years. For Booklet, write The Kirk & Blum Mfg. Co., 2808 Spring Grove Ave., Cincinnati 25, Ohio.

One Undivided Responsibility
DESIGN...FABRICATION...INSTALLATION
For all three—call on K&B

FOR CLEAN AIR... THE INVISIBLE TOOL

KIRK AND BLUM

DUST CONTROL SYSTEMS

REDUCE Rejects... Parting Troubles... Foundry Smoke

USE **"dag"** colloidal graphite dispersions for permanent molds and die casting. Easily applied by brush or spray, they prevent adhesion of cast objects to molds, patterns, cores, ladle interiors and chills.

This results in better parting, better reproduction, smoother surfaces . . . FEWER REJECTS, LOWER FINISHING COSTS.

It also improves metallurgical quality since **"dag"** colloidal graphite adsorbs oxidizing gases. Gives the men in the shop a break, too, because when dispersed in water **"dag"** colloidal graphite does not give off the choking smoke and fumes usually produced by oily parting compounds.

The new Bulletin #425 tells how to use **"dag"** colloidal graphite in the foundry . . . to save headaches and dollars. Fill in coupon and mail today.

Acheson Colloids is equipped to do custom disintegrating, dispersing, and stabilizing of solids in a wide variety of vehicles. If you are in need of this type of service, tell us about it. We may be able to help you.

ACHESON COLLOIDS CORPORATION
Port Huron, Michigan

☐ Send me the NEW Foundry Bulletin #425

☐ Send an Acheson engineer

NAME.....

COMPANY.....

STREET.....

CITY.....ZONE.....

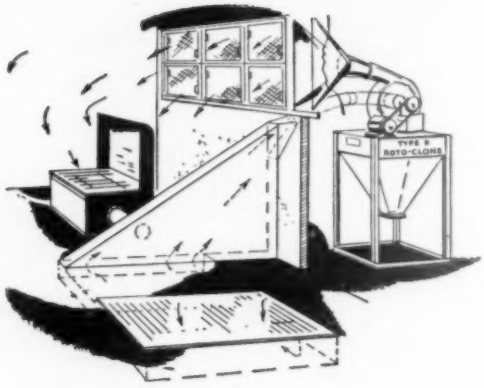
STATE.....

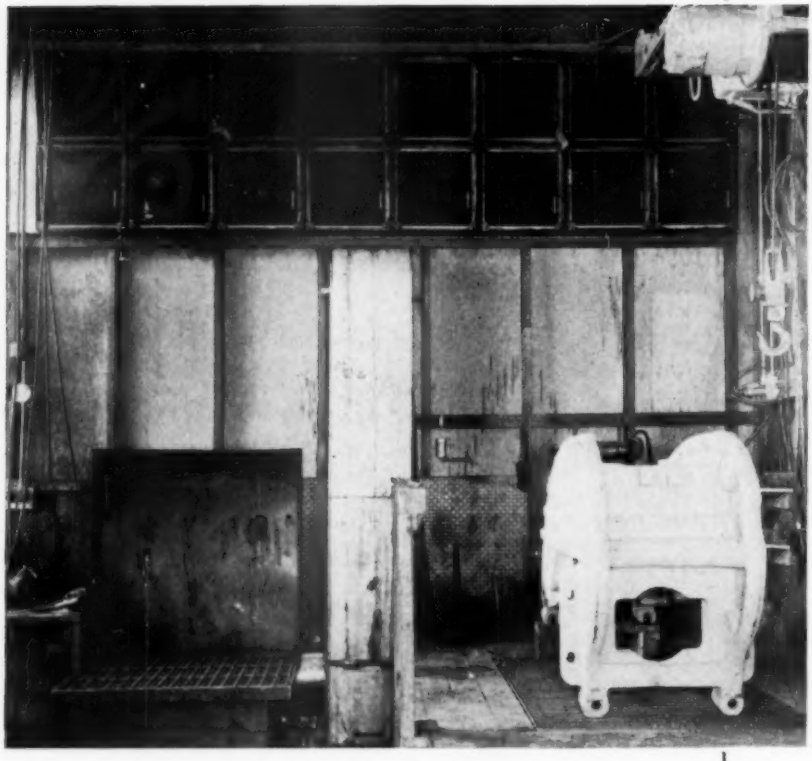
M-14

dag DISPERSIONS

Acheson Colloids Corporation, Port Huron, Michigan
...also Acheson Colloids Limited, London, England

ROTO-CLONE
solves "twin" dust problems





HERE'S a potential dust storm that never materialized. Pictured at left are "twin" grinding operations for finishing both small and large castings. Double Trouble? Not a bit—the combined dust load is handled efficiently and economically by a Type D Roto-Clone*.

Now examine the drawing above. Note how the dust-laden air is drawn from both the down draft bench and floor grating into a common plenum chamber and then into the Roto-Clone. Dust is discharged into the hopper and the air is exhausted through a bank of AAF Type M/W4 viscous unit filters for final cleaning before recirculating to the working area.

The simplicity and efficiency of Roto-Clone equipment enables you to apply positive dust control to more operations at lower cost. An AAF engineer will be glad to analyze the dust-producing operations in your foundry or plant and show you how Roto-Clone can solve your problem at a saving. Call your local AAF representative today or write direct to

AMERICAN AIR FILTER COMPANY, INC.
266 Central Avenue, Louisville 8, Ky.
In Canada: Darling Bros., Ltd., Montreal, P.Q.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

**Roto-Clone is the trade mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydrostatic precipitator types.*

AAF

ROTO-CLONE®
DUST CONTROL EQUIPMENT

Refractory Cement Selection Made Easy

for ferrous melting furnaces

Type of furnace	metals melted	use of cement	Norton number	cement recommended description	maturing temp.	max. temp.	how applied
indirect arc	alloy iron and malleable iron	lining	RA1144	coarse grain Alundum* cement	2100°F	2950°F	rammed
		patching	RA1160		1850°F		rammed
		troweling around electrodes	RA162	fine grain Alundum cement	1850°F	2950°F	troweled
direct arc	alloy steel and malleable iron	lining roof and around electrodes	RA1144	coarse grain Alundum cement	2100°F	2950°F	rammed
		lining roof and around electrodes	RA1195	very coarse grain Alundum cement	2000°F	3100°F	rammed
		patching	RA1160		1850°F		rammed
high frequency induction	stainless steel and refractory alloys	lining	RM1169	very coarse grain Magnorite* cement	2100°F	3250°F	rammed (dry)
		patching large furnaces	RM868	medium grain Magnorite cement	2200F°	2750°F	rammed
		patching small furnaces	RM1171	medium grain Magnorite cement	2000°F	2900°F	troweled or rammed

for non-ferrous metal-melting furnaces

low frequency induction	refractory alloys, cupronickel, nickel silver, high copper alloys Al, Te, Si bronzes	lining	RM1140	coarse grain Magnorite cement	2300°F	3250°F	rammed
	nickel silver	lining	RA1195	very coarse grain Alundum cement	2000°F.	3100°F	rammed
	brasses not more than 90% copper or less than 10% zinc	lining	RA1144	coarse grain Alundum cement	2100°F	2950°F	rammed
indirect arc	nickel and high nickel alloys	lining	RA1144	coarse grain Alundum cement	2100°F	2950°F	rammed
		patching	RA1160		1850°F		
crucible melting furnaces■	brasses and bronzes	lining and patching	RC1188	coarse grain Crystolon* cement	2000°F	3050°F	rammed
		lining and patching	RC1133	coarse grain Crystolon cement	2100°F	2950°F	rammed
		lining and patching	RC1204	coarse grain Crystolon cement	2000°F	2900°F	rammed
reverberatory furnaces▼	brasses and bronzes	lining and patching	RC1188	coarse grain Crystolon cement	2000°F	3050°F	rammed
		lining and patching	RC1133	coarse grain Crystolon cement	2100°F	2950°F	rammed
		lining and patching	RC1204	coarse grain Crystolon cement	2000°F	2900°F	rammed

■ Cement not in contact with metal, used in combustion chamber.
▼ Cement in contact with metal. * Trade-marks Reg. U. S. Pat. Off. and Foreign Countries.

This Chart is a synthesis of several charts from a new 16-page bulletin just prepared by Norton refractory engineers, after exhaustive laboratory and field tests.

Titled "Norton Longer Lasting Refractory Cements," this fact-packed bulletin covers the properties, selection and application of the correct cement for your refractory requirements.

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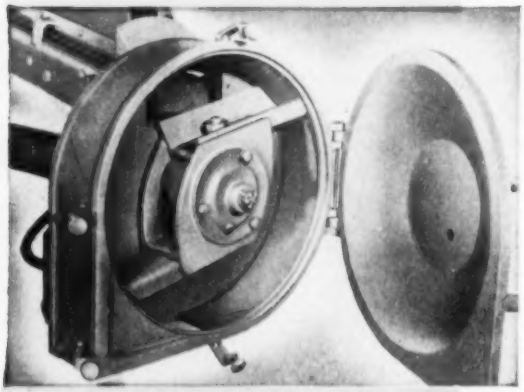
New, Economical Impellor Head Design



Close-up of interior of Impellor Head. Note how blades are adjustable. This compensates for wear, giving blades a five-fold life over conventional-type impellor mechanisms. Also, *density* of mold can be controlled by blade adjustment. Mold is rammed at phenomenal speed, with equal density throughout the whole area and depth.

Here are two Sandrammers whose *low cost* will justify their use in foundries where such equipment formerly seemed prohibitive.

These machines handle a great range of mold sizes and depths. They are strong, efficient, precision-built. Trolleys and swivels are finely-balanced—ball-bearing mounted for effortless operation. Simple, sequence, push-button controls are at the operator's finger-tips. All mechanical and electrical working parts are fully-enclosed to keep out dust and dirt.

Both machines are so flexible, can produce so many high-quality molds, that molding costs can be reduced by as much as 50%.

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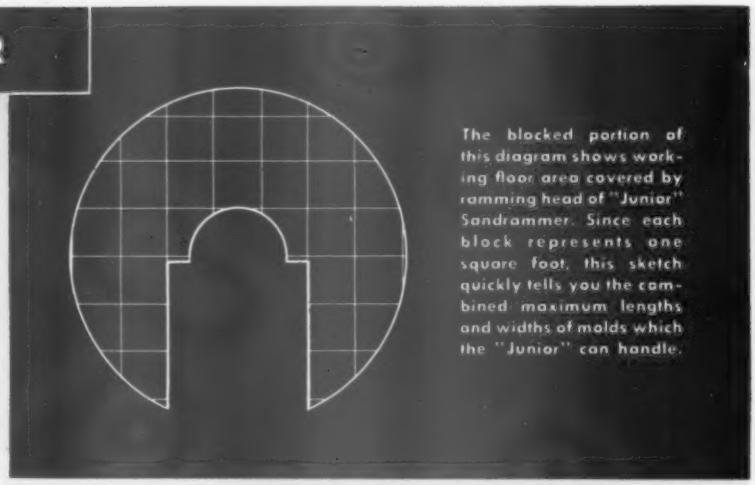
The "Junior" SANDRAMMER

The "Junior" is ideal for core room or small jobbing floor. It will quickly pay for itself in ramming up molds from loose patterns (always a headache), and for short-run core production. "Junior" also is capable of handling light to medium production work in both core room and foundry.

Has self-contained magnet in primary chute to remove metallic particles from sand. "Junior" is portable—can be moved by crane to molding areas, or mounted on rail car for along-track ramming. Adaptable to hand, hoist, or over-head system sand feeding.



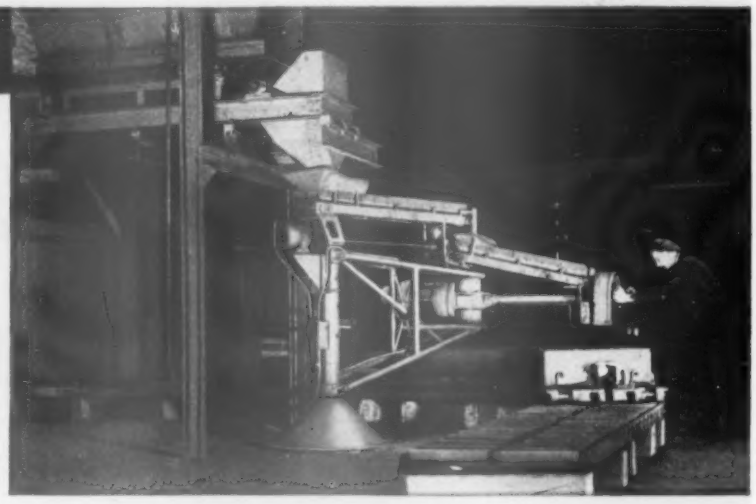
The blocked portion of this diagram shows working floor area covered by ramming head of "Junior" Sandrammer. Since each block represents one square foot, this sketch quickly tells you the combined maximum lengths and widths of molds which the "Junior" can handle.

"JUNIOR" SPECIFICATIONS

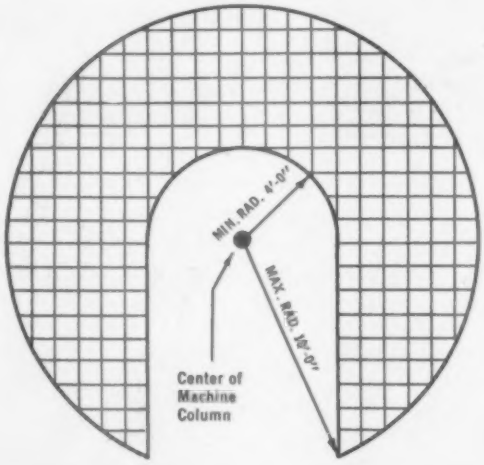
Height from floor to top of hopper	8'-8¾"
Height from floor to sand discharge point	2'-10½"
Max. height of flask	2'-9½"
Hopper capacity	675 lbs.
Sand throwing capacity	Up to 150 lbs. per minute

The SANDRAMMER

Sandrammer is a first-class production machine. It fits in well with heavy foundry floor work. In addition, Sandrammer finds many applications in the making of large cores, or in long-run core production service. It's highly flexible—lending itself to roller conveyor (as illustrated in the picture) or turntable arrangements.



A Sandrammer installed in a large automotive foundry.



The blocked portion of this diagram shows working floor area covered by ramming head of Sandrammer. Since each block represents one square foot, this sketch quickly tells you the combined maximum lengths and widths of molds which the Sandrammer can handle.

SANDRAMMER SPECIFICATIONS

Height from floor to top of feed chute	7'-0"
Height from floor to sand discharge point	3'-0"
Max. height of flask	2'-9"

(Sandrammer—being stationary—can be mounted on a raised concrete base, thus increasing maximum height of flask at no sacrifice to ramming efficiency.)

Sand throwing capacity	Up to 500 lbs. per minute

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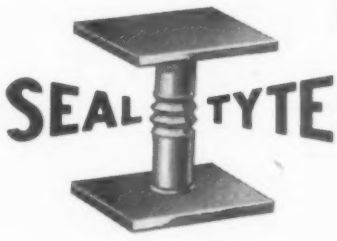

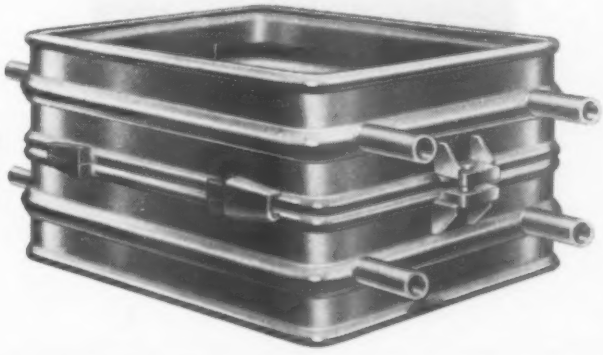

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ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Division, Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario

How Ladle Inoculants Reduce Chill Depth ...Produce High-Strength, Machinable Iron

One of the most significant developments in the field of cast iron metallurgy during recent years has been the widespread growth of the process of "inoculation" in producing quality metal to strict specifications. Inoculation has been defined as "a process in which an addition is made to molten cast iron for the purpose of altering or modifying the micro-structure of the iron and thereby improving the mechanical and physical properties to a degree not explainable on the basis of the change in composition."*

Various ladle addition alloys are used for inoculation of cast iron, but there is a wide range in the efficiency and potency of these materials. The 50 per cent and 75 per cent ferrosilicons are mild inoculants, but they are used as ladle additions principally as a means of adjusting the silicon content of cast iron. The 85 per cent and 90 per cent grades of ferrosilicon are much more effective inoculants. Inoculating power is further improved through the use of special inoculating alloys, such as silicon-manganese-zirconium ("SMZ" alloy) and calcium-silicon.

ELECTROMET produces a number of alloys for inoculation, each of which has specific applications. The graphitizing inoculants are:

"SMZ" Alloy	60-65% silicon 5-7% manganese 5-7% zirconium
Calcium-Silicon	30-33% calcium 60-65% silicon
90% Ferrosilicon	92-95% silicon
85% Ferrosilicon	83-88% silicon
Special Graphitizer	A mixture of ferrosilicon and graphite for special uses.
75% Ferrosilicon	73-78% silicon
50% Ferrosilicon	47-51% silicon
Ferromanganese-Silicon Mix	20-25% manganese 47-54% silicon

These inoculants are usually added to the molten iron as it leaves the cupola spout, or during transfer from one ladle to another.

*Definition by H. W. Lownie, Jr.—A.F.S. Symposium on "Inoculation of Gray Cast Iron."

Effects of Inoculation

The effects of graphitizing inoculants are: a drastic decrease in the chilling tendency of a given iron, a mild decrease in Brinell hardness, lowering of the section sensitivity of the metal, a definite increase in tensile strength, and an increase in transverse strength and deflection. These benefits are usually accompanied by improved fluidity, better castability, and improved resistance to wear.

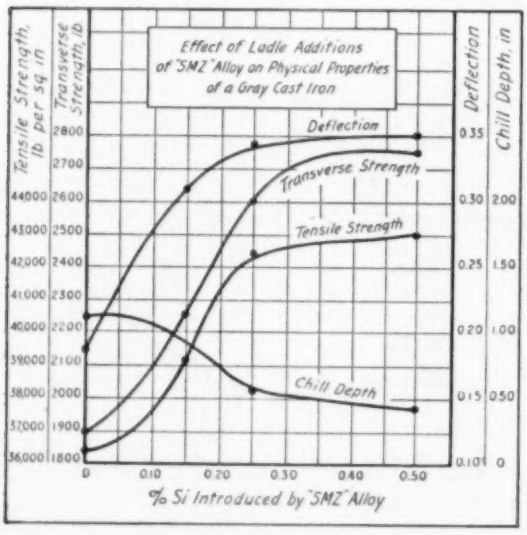
Effect of Ladle Additions of "SMZ" Alloy on Physical Properties of a Gray Cast Iron
Tensile Strength, lb per sq in
Transverse Strength, lb
Deflection
Chill Depth, in
Deflection
Transverse Strength
Tensile Strength
Chill Depth
% Si Introduced by "SMZ" Alloy

Fig. 1—These curves show how additions of "SMZ" alloy reduce depth of chill and improve mechanical properties when added to a series of irons selected to give the following final analysis: 3.10 total carbon, 0.60 combined carbon, 1.80 silicon, and 0.50 manganese.

Stabilizing Inoculants

In addition to the graphitizing inoculants listed above, there are several stabilizing inoculants containing substantial percentages of chromium. These inoculants improve resistance to wear, heat, and corrosion, with no appreciable increase in the chilling tendency. Stabilizing inoculants furnished by ELECTROMET include:

"CMSZ" #4 Mixture	45-49% chromium 4-6% manganese 18-21% silicon 1.25-1.75% zirconium
"CMSZ" #5 Mixture	50-56% chromium 4-6% manganese 13.50-16.00% silicon 0.75-1.25% zirconium
Low-Carbon Foundry Ferrochrome No. 2	50-54% chromium 28-32% silicon 1.25% max. carbon

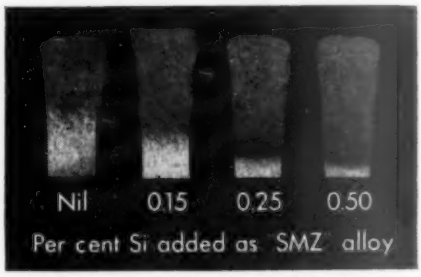

Fig. 2—These chill blocks show how progressive additions of "SMZ" alloy reduce the depth of chill.

"SMZ" Alloy—An Efficient Inoculant

The benefits of inoculation are obtained largely as the result of rigid control of the structure of the graphite phase of cast iron which has received this treatment. The results of inoculation on the properties of a typical cast iron are demonstrated by the accompanying illustrations showing the effect of adding various amounts of "SMZ" alloy.

Booklets Available

Further information about ladle inoculants is given in the booklets, "SMZ Alloy and Its Uses as a Ladle Addition to Cast Iron" and "CMSZ Mixtures for Ladle Additions of Chromium to Cast Iron." You may obtain copies, free of charge, by writing or phoning to the address given above or to the nearest ELECTROMET office: in Birmingham, Chicago, Cleveland, Detroit, Los Angeles, New York, Pittsburgh, or San Francisco. In Canada: Welland, Ontario.

The terms "CMSZ," "EM," "Electromet," and "SMZ" are registered trade-marks of Union Carbide and Carbon Corporation.

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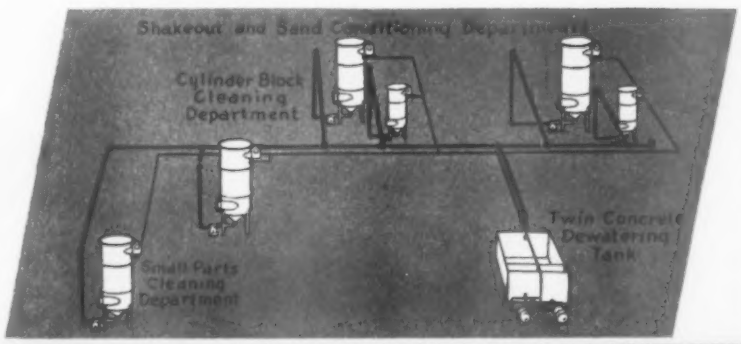
Shakeout and Sand Conditioning Department
Cylinder Block Cleaning Department
Twin Concrete Dewatering Tank
Small Parts Cleaning Department

Diagram shows a typical Schneible Multi-Wash system with Central Dewatering tank as applied to an automotive foundry. Many Multi-Wash units may be added to this type of layout without additional expense for Dewatering facilities.

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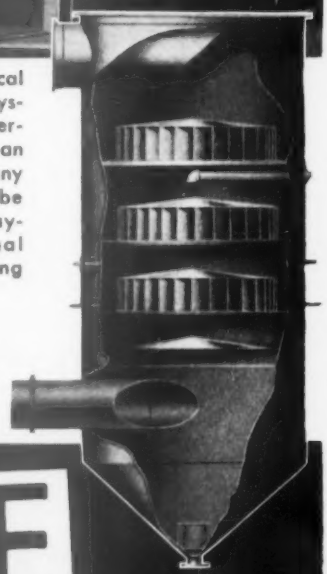

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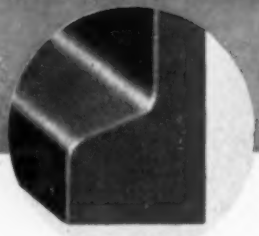

Section of Sterling Flask Showing Machined Partings and Full Width Bearing.

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Foundry Representation Needed at Washington

WITH tenseness in the international situation increasing alarmingly, and since the administration need not worry longer about irritating voters before election, an influx of government orders limiting the use of practically all types of metals seems likely. As this is written, civilian use of aluminum has been reduced drastically and similar orders are anticipated momentarily on other nonferrous metals, including copper.

National Production Authority order, M 7, cuts the use of a wide variety of aluminum products, including castings, to 65 per cent of the base period, which is the first six months of 1950. This aluminum order may result in the closing down of some foundries since it is not conceivable that at the moment defense orders are available in sufficient volume to take up the slack.

Industry will not quarrel with any steps required to conserve materials for the present or future emergencies. But it does seem that such regulations should be prepared with the advice and assistance of those industries vitally interested, so that as much violence as possible will be removed from the period of transition to military production. In the case of foundries, this is not being done.

If the foundry industry is to hold itself in readiness to meet increasing defense demands, its present problems must be understood and recognized. The industry needs representatives in the NPA who are thoroughly familiar with the various ramifications of castings production, and who will be concerned with these control problems as they arise. Two and a half months ago each branch of the industry recommended names to NPA from which industry advisory committees could be selected, but no action had been taken by the middle of November. The three ferrous branches, working jointly, have been promised a Castings Branch under the Steel Division, but as yet this branch has not been activated. Likewise, the nonferrous branches of the industry are waiting for the establishment of branches under the Copper and the Aluminum and Magnesium Divisions.

Back in 1941, when the writer was attached to the Office of Production Management, the members of that organization were constantly reminded of the urgency of the situation with placards reading "It's later than you think." As far as the foundry industry is concerned, it is later than some government people think.

It is time that the various branches of the NPA set up the organizations which will permit this basic industry to render maximum service to the nation in this emergency.

Frank G. Steinebach
Editor

Insulation

By W. H. PIPER JR.
Foundry Superintendent
Erie Bronze Co., Erie, Pa.
and JAMES O'KEEFFE JR.
Metallurgist
Exomet Inc., Conneaut, O

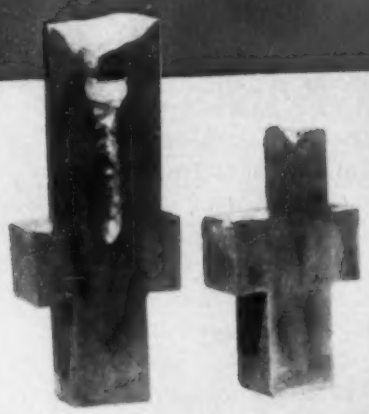

Fig. 1—Comparison of sectioned "T" casting made with normal riser (left) and insulated riser (right)

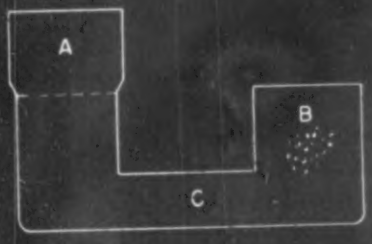

Fig. 2—Shrinkage in section B occurs because thin section C freezes, preventing feeding from riser A

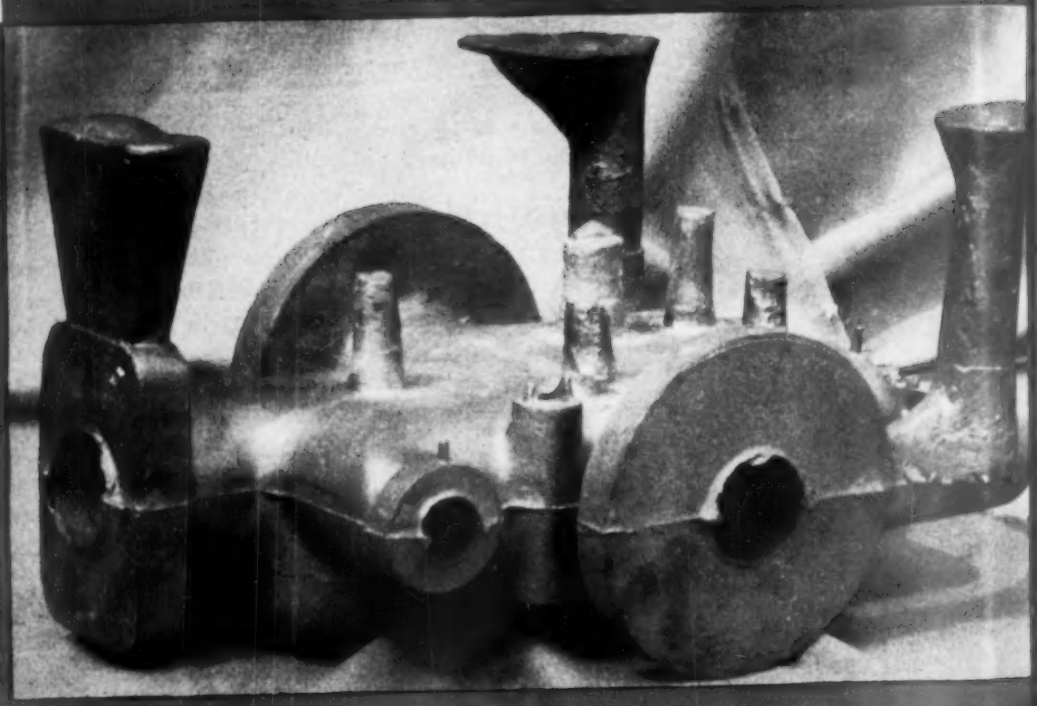

Fig. 3 *(above)*—Isolated heavy sections of this valve casting require five properly positioned small insulated risers rather than one or several large risers

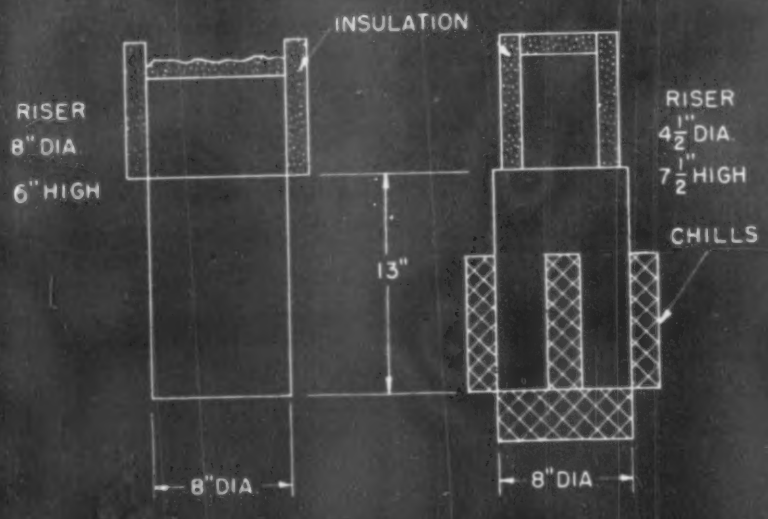

Fig. 4 *(left)*—Casting at left, made in sand, had riser volume of 300 cu in. By using chills the same casting could be made with a riser volume of 119 cu in.

Fig. 5 *(right)*—Indicated volume feed of over 6.5 per cent occurred in casting this cylindrical bushing. Dimensions: 8-in. ID, 11-in. OD, 13-in. width

More than 2000 riser sleeves have been used by one jobbing foundry the past year in producing bronze castings. How this riser insulation is applied to result in sounder castings and increased metal yield is detailed here

Increases RISER EFFICIENCY

DURING the past year insulated risers have been used at the Erie Bronze Co., Erie, Pa., to produce castings typical of a nonferrous bronze jobbing foundry. In this time over two thousand riser sleeves have been used to produce miscellaneous castings on short-run jobbing work. As is usual in jobbing foundries, quick delivery was required and the castings on which the riser sleeves were used were usually for one or two castings from a pattern.

This experience convinces us that insulating riser sleeves are an excellent tool for the nonferrous foundryman. For production work, smaller risers and increased yield result in cost savings and increased production. For jobbing work, castings can be produced on the first trial which are dependably free from shrinkage defects such as spongy areas, low density metal, cracks and draws in the vicinity of the riser, and shrinkage voids.

In addition, by using insulated risers, the foundryman can produce jobbing castings with a high yield. Normally jobbing castings are made with large risers to assure sound castings. Most foundrymen are satisfied if they can get 50 lb of saleable product from 100 lb of metal poured. When the risers are insulated, however, over 80 per cent of metal poured results in salable castings.

It is the purpose of this paper to report the general method of using insulated risers which has been followed successfully at the Erie Bronze Co., with the hope that this information will be of interest and value to other nonferrous foundrymen.

Previous Work Unsuccessful—The use of insulating material for risers of nonferrous castings has been reported in the technical press in several recent articles. However, experiments at this foundry with the materials recommended in several earlier publications had not worked out satisfactorily. In the first place, certain of the mixtures which had been tried would not give sufficient insulation to do the job required. Of more importance from an operating standpoint was the presence of moisture in the insulating mixture. It was very difficult to control this moisture and in several experiments the result was a violent gas evolution which made the process hazardous.

These disadvantages were overcome by using an adequately dried gypsum base insulating material. The insulating sleeve is protected from moisture pick-up during storage by a suitable plastic covering which is heat-sealed to keep out all moisture. This covering may be polyethylene, polyvinyl, moisture-proof cellophane, etc.

Three Requirements of Risers—Risers are used in the casting process to fulfill three fundamental requirements.

1. The riser is designed so that sufficient liquid metal will be available to compensate for volume contraction in the casting cavity during solidification.
2. The riser is designed to contain sufficient heat to set up the necessary temperature gradient for directional solidification of the casting to the reservoir of molten metal which is available in the riser, and
3. By remaining liquid while the casting is undergoing the change from liquid to solid, the riser maintains a hydrostatic system which assists in the formation of a sound, dense casting.

Unfortunately, data available in the literature on the exact shrinkage characteristics of the variety of bronze alloys in production today are quite limited. However, for most of the alloys encountered in the bronze foundry between 5 and 7 per cent of the total finished weight of the casting must be supplied from the risering system. That is, in producing a casting

which would theoretically ship at 100 lb net weight, between 5 and 7 lb of this metal must enter the casting from the riser or risers, *during the solidification process.*

For the riser to perform its function, there must be sufficient liquid metal to satisfy the volume contraction which takes place in the casting proper. Further, this liquid metal must be available in the *liquid state* at the time the casting requires feed metal. The riser must therefore be positioned to conform to the laws of directional solidification. That is, solidification must take place progressively from the point at which the metal begins to solidify toward the riser, and the last liquid to solidify must be in the riser. For this reason, the riser must be large enough to contain the required amount of molten metal after solidification has taken place in the casting and in the riser itself.

As will be noted in Fig. 1 the T-shape casting shows that the rate of solidification in the riser is approximately that of the casting itself. In this case the liquid metal present in the unsolidified portion of the riser was entirely insufficient to compensate for the shrinkage in the casting. The result, therefore, is a shrinkage defect in the casting.

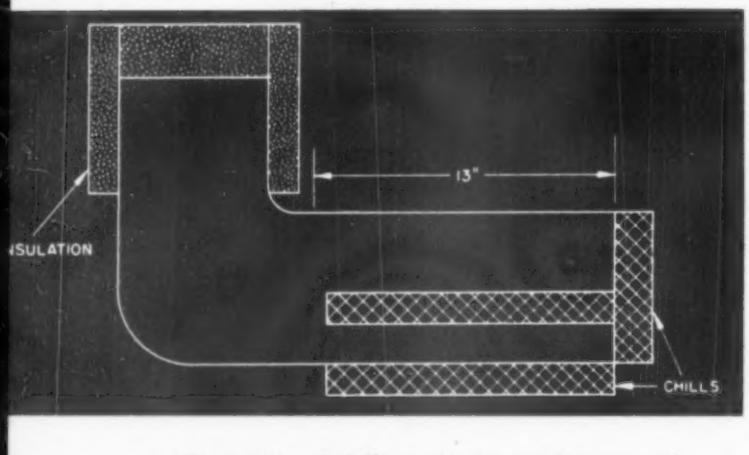

Fig. 6—Use of chills on this bronze bar assured directional solidification. Insulated riser used was 6 in. ID and was poured to height of 5½ in.

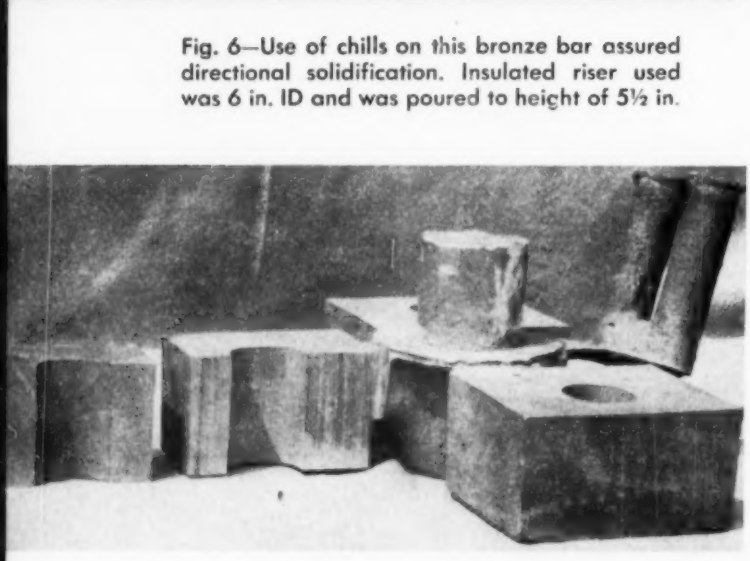

Fig. 7—Three camshaft bearings fed from common riser 2.50 in. ID. Castings had 51-lb net weight, 68-lb gross weight, giving 75 per cent yield

Notice now, the casting on the right in Fig. 1. *Even the riser is sound.* This evidence indicates that solidification was progressive in the casting toward the molten metal in the insulated riser. And further, this solidification progressed so that the metal in the riser itself was free of any large shrinkage voids.

We can say, then, that the volume contraction taking place when metal solidifies can be controlled in a progressive manner. The solidification can be made to progress from the point at which the metal starts to solidify to the reservoir of molten metal. To produce sound castings with a high yield, risers must be positioned so that each riser feeds the casting, or the casting section, which is assigned to it. And the riser, or risers, must be large enough to provide the required volume of liquid metal after solidification has taken place in the casting and riser at about the same rate.

Justification for Insulation—As illustrated in Fig. 1, when the material used to form the riser cavity has the same heat transfer properties as the molding material for the casting, the mass of metal in the riser will lose heat, and so solidify, at a rate approximately that of the casting itself. If the riser is then to supply *any* liquid metal to the casting, the riser must be larger in section than the casting section it is to feed. This means that the risers must be large or, put in another way, that the yield will be low. Therefore, the melting cost for the salable product will be high. This also means that large risers must be removed from the casting. This often presents a considerable problem in all small foundries and in many large shops.

Our experience had also been that castings risered in the normal manner were undependable. Often it was necessary to make a casting three or four times before we could develop a technique which would produce a salable product. In a jobbing foundry it is not possible to produce a casting three or four times before making a salable product and still operate profitably.

For this reason we were anxious to use a material with the required heat transfer properties to improve risering practices. As will be noted in Table I, by using the gypsum base insulating sleeve, this was done. In a sand cavity of 27 cu in., the metal solidified in 2 minutes. However, the metal in an insulated cavity of the same size remained molten more than 10 minutes. Also, the metal in a 69.75-cu in. sand cavity solidified in 4½ minutes; the metal in a similar insulated cavity remained molten 22 minutes.

As indicated in Table I, top insulation was provided for the molten metal in the insulated cavities. We were also interested in determining whether or not an exothermic material on the top of the riser would be preferable to the insulating material. We found that the metal in the 69.75-cu-in. insulated cavity remained molten 27 minutes when an exothermic hot topping compound was used on top of the riser.

It is therefore evident that by using the insulating sleeves and top insulation or exothermic hot top-

TABLE I—Time Required for Bronze* To Solidify in Sand and Insulated Cavity

Cavity Diam, in.	Cavity Ht, in.	Cavity Vol, cu in.	—Time (minutes) for Solidification— Sand Cavity	Insulated Cavity, Top Open	Insulated Cavity, Top Insulated**
2.00	5.50	17.3	1½	3	4½
2.50	5.50	27.0	2	6	10
3.50	7.25	69.7	4½	11½	22***

* Metal was 80-10-10 poured at 2050-2075° F.
** Previously used sleeves crushed and used to insulate top surface.
*** When exothermic hot-topping was used to cover the top of this size cavity, the metal remained molten for 27 minutes.

ping compound, we can maintain a reservoir of molten metal for a considerable length of time. It is further evident that the selection of the correct insulated riser can be resolved to (a) proper positioning of the riser or risers on the casting to conform to the known laws of metal solidification, (b) choosing dimensions which will supply the required amount of feed metal at the time that feed metal is required in the solidification process.

Positioning of Risers—A riser must be placed in a position which will allow it to feed the section assigned to it—solidification of the casting must proceed *directionally* from the point at which solidification starts to the source of liquid feed metal contained in the insulated riser. In general the feeding range of a single insulated riser for sections 1 to 2 in. thick is only 12 in. Therefore, on rings, flat plates and similar castings for pressure service, risers are placed on approximately 24-in. centers. By using chills to increase the rate of solidification and to control solidification, this range may be increased slightly.

It is also necessary to position the riser so that thin sections do not freeze and prevent feeding thick sections more remote from the riser. This is illustrated in Fig. 2. An example of this in a casting is shown in Fig. 3, which is a valve casting having isolated heavy sections on the interior. Five small insulated risers were required for proper feeding. The amount of metal required from each riser was small but we would like to emphasize the positioning required in this case—five small risers rather than one or several large risers.

Dimensions of Risers—To determine the correct dimensions for the insulated riser, it is necessary to know the volume of feed metal which must be transferred from the riser to the casting, and also the time that the riser must remain molten. The absolute minimum riser would (*Please turn to page* 134)

Fig. 8 *(top right)*—Gross weight of this ring pot casting 1100 lb. Net weight 948 lb, yield 86 per cent. Six 3.50-in. ID insulated risers 7½ in. high were 4¼ in. high on solidification

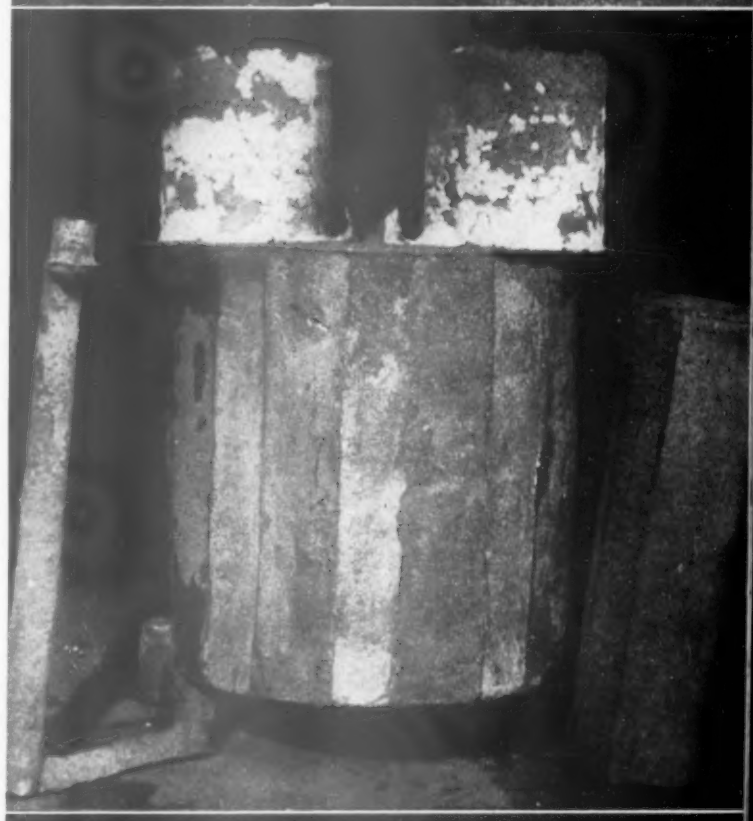

Fig. 9 *(center)*—Navy "G" bearing, 1½ in. ID, 12½ in. OD, 13¼ in. high. Eight graphite chills, 4x4x15 in., (as shown at right) and two, 5.5 ID, 7½-in. high insulated risers were used. Casting net weight 528 lb, giving 84.9 per cent yield

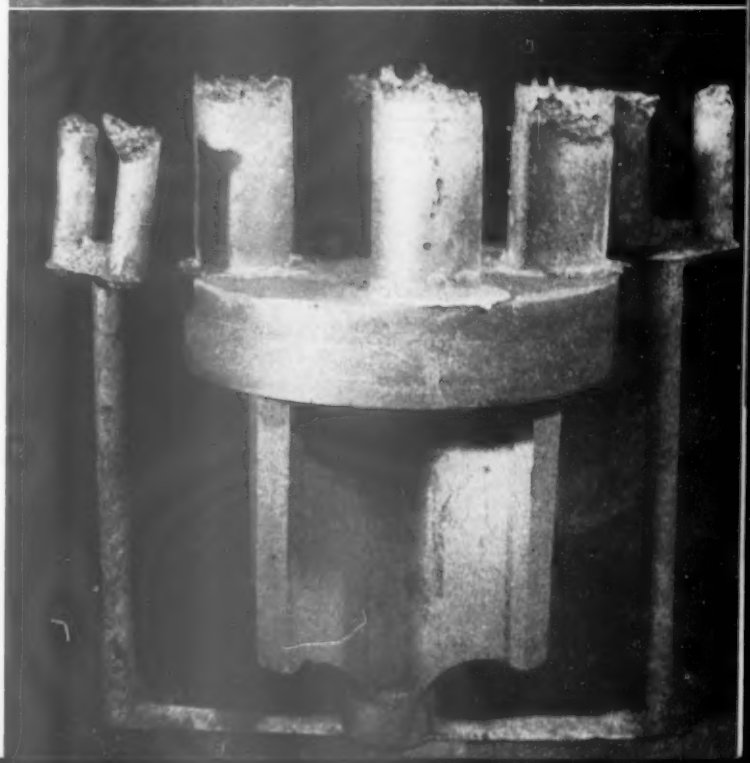

Fig. 10 *(bottom)*—Manganese bronze valve stem. Net weight of 259 lb represented 78.5 per cent yield. Four 2.5-in. ID insulated risers were poured 5½ in. high and fed with furnace metal

METALLIC AND NONMETALLIC

Coatings for Gray Iron

By CHARLES O. BURGESS
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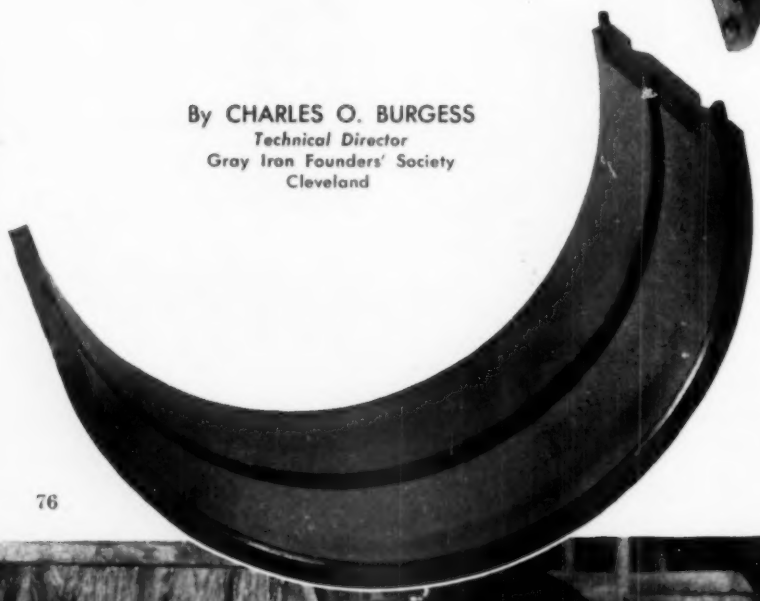
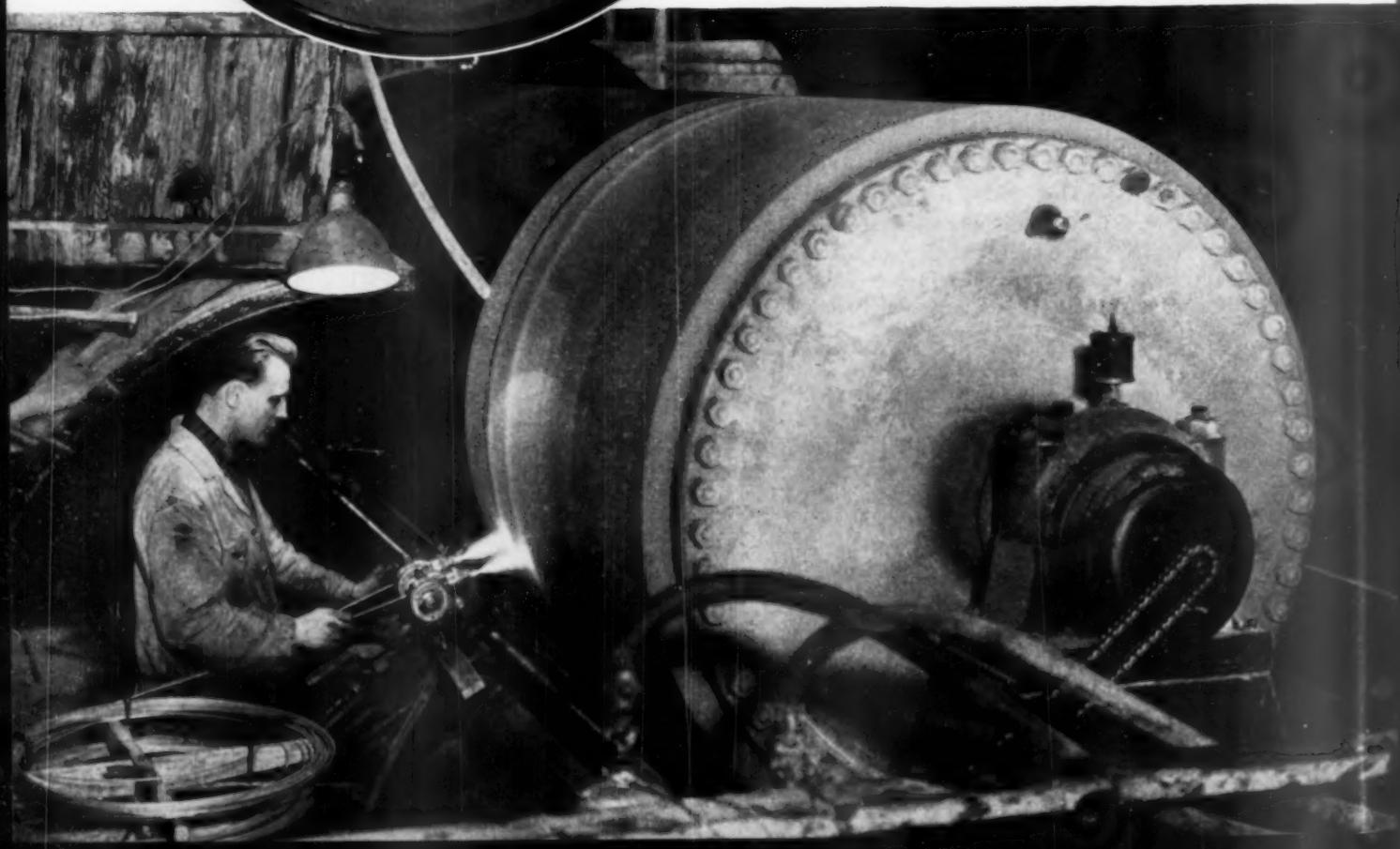


This is the first of three articles discussing coatings successfully applied to gray iron castings on a commercial scale to meet appearance, corrosion, wear or other requirements. Material from which these articles are taken is copyrighted by the Gray Iron Founders' Society. Complete reprints of the series can be obtained from the society, 210 National City-East 6th Bldg., Cleveland, 14

Fig. 1 *(above)*—Babbitted cast iron bearing shell for main bearing of a diesel engine

Fig. 2 *(below)*—Taking preliminary roughing cut and applying a sprayed stainless steel surface to a gray iron roll in one operation



DECISION as to the best metal for a specific job is often based solely on whether the surface of a given metal will resist the corrosion, wear, or other special industrial hazards involved. Operational efficiency and cost of two or more metals being equal, the best-appearing material will then be chosen, and this is again based on surface considerations. Since gray iron very frequently exhibits advantages in both efficiency and cost, the subject of surface finishes—metallic or nonmetallic—available in the case of gray iron and the methods by which they may be applied is of vital importance to both purchasers and producers of castings.

The present discussion is devoted to metallic and nonmetallic coatings that have been successfully applied to gray iron on a commercial scale to meet appearance, corrosion, wear or other requirements.

Methods of applying coatings include spraying, brushing, welding, cementation, dipping, chemical conversion, or electroplating. Because the information on coating processes is so extensive and developing so rapidly, only the possibilities of each type of surface treatment and the most widely accepted method of application can be outlined.

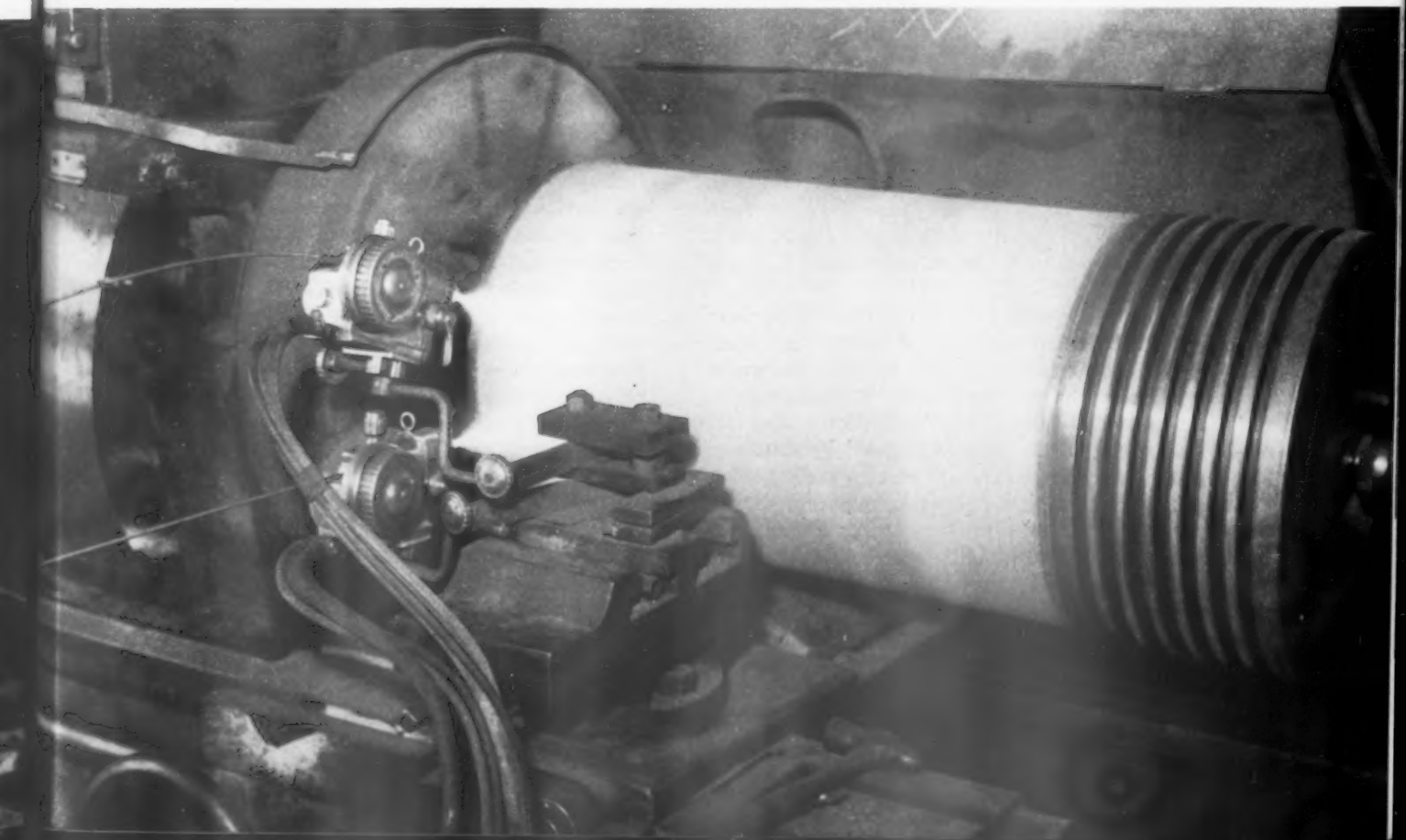
Sprayed Metal Coatings—Metal spraying, i.e., the creation of a metallic spray of atomized molten metal and its deposition (by means of a spray gun) on the surface of base metals like cast iron, is assuming an increased commercial importance. Utilizing this process, inexpensive readily-cast materials such as gray iron can be employed in the core or main body of a part, and the desired metal sprayed on surface areas which must withstand severe wear, extreme corrosion or possess other unique properties of the deposited metal.

Practically every metal available in wire or powder form, including brass, bronze, copper, silicon-bronze, aluminum-bronze, aluminum, magnesium, lead, tin, iron, zinc, cadmium, babbitt, nickel, carbon steels, alloy steels, Monel, stainless steels, Stellite alloys, molybdenum, tantalum, Nichrome, etc., has been successfully sprayed.[1] This means the indicated metal in either wire or powder form has been progressively fed into and melted by the oxygen-gas flame of the spray gun, and the small molten globules of metal picked up by a blast of compressed air have been successfully deposited on a prepared surface.

One striking example of the use of this method is the coating of gray iron rolls with stainless steel.[2] For example, a 6300-lb chill roll for animal fat rendering, equal in efficiency to a solid stainless steel roll, was successfully produced from gray iron by simply metallizing the roll surface with a $\frac{1}{8}$-in.-thick layer of sprayed stainless steel. The operation required only three 8-hour shifts to complete. Another company[3] reports successful production of stainless steel and other types of sprayed surfaces on cast iron rolls as large as 9 ft in diameter and 9 ft long for use in rubber manufacturing, and is actively engaged in extending the process to rolls used in other industries. The accompanying illustrations show the spraying techniques as applied to a large roll and to a hydraulic ram which is required to resist 4500 psi in the sprayed gland area.

The same technique has been used to coat cast iron lathe beds with hardened steel, bearing surfaces of air compressors with stainless steel where electrolytic action is a factor, and to develop special sur-

Fig. 3—Spraying gland area of a gray iron ram with stainless steel by means of a spray gun



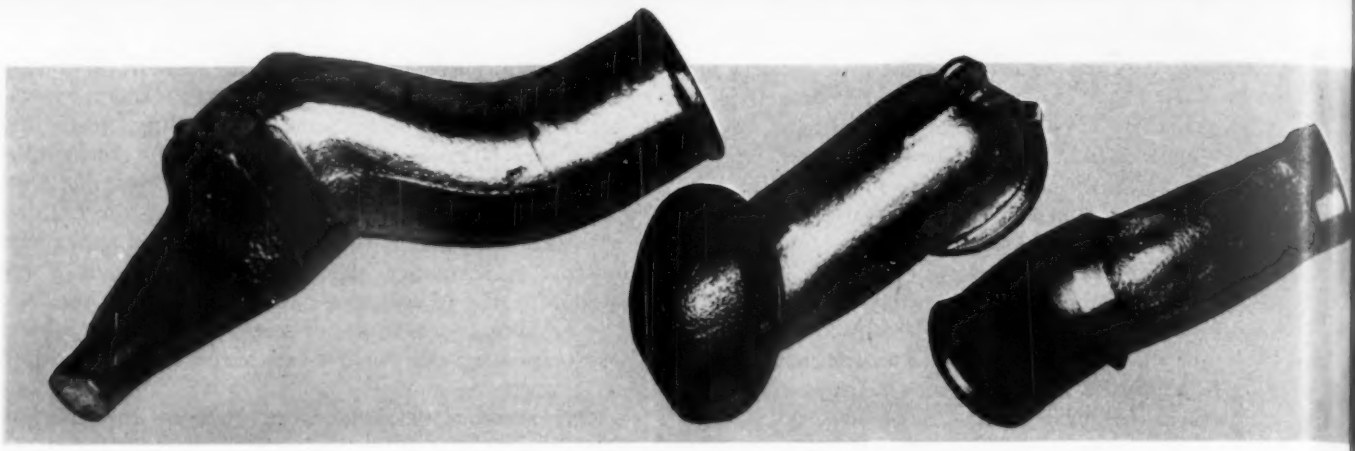


Fig. 4—These tinned gray iron radiator castings previously had been cleaned by the Kolene method

faces on many other types of gray iron castings. It has proved of special value in depositing metals such as lead and aluminum which do not readily alloy or adhere to ferrous metals.[4] Special after-treatments are occasionally employed, such as light shot blasting, to densen a lead coating,[5] reheating aluminum coatings to promote actual alloying with the base metal, etc.

Since the bond between the base metal and the sprayed metal is largely mechanical, one of three processes of surface preparation is necessary prior to spraying. First, for relatively thin coatings, pressure blasting with sand, Joplin grit or angular steel grit is usually sufficient to key the deposited metal to the base metal. If heavier coats are to be applied, a roughing cut or rough threading cut is frequently taken, sometimes followed by knurling the surface to be sprayed. This is the most common method of preparation for heavy coats, and the advantage of using a readily machinable base metal, such as gray iron, is at once apparent.

A second method is to use an undercoat produced by stroking a series of nickel electrodes across the prepared surface so as to produce a frothy, shallow layer of nickel.

A third method involves the preliminary use of a newly developed, self-bonding wire of molybdenum in the spray gun previous to deposition of the desired metal.[6] The molybdenum, with careful gun control, actually welds to the base iron surface. Use of this "gray bond" method on sand-blasted castings is reported to be most economical in many cases.

Because of the method of deposition there is a tendency for a small amount of oxide and some voids to be present in all sprayed layers. The voids, or fine porosity, have been found of advantage in reducing wear in lubricated applications. On the other hand, this same porosity may necessitate a heavier than normal coating of certain metals when the coating is required to resist penetration of corrosive fluids. A table of life expectancy of different thicknesses of zinc and aluminum metallized coatings in contact with various atmospheres has been prepared.[10] In critical areas, casting thickness can, of course be readily increased using the spraying technique.

One of the advantages of the spraying operation, as compared to other methods of coating castings, is that it usually can be done rapidly. For example, while normally only 3 or 4 lb of metal per hour are deposited by welding, some 20 lb of metal can be applied by spraying in an equal length of time. As much as 55 lb of zinc per hour have been deposited.[9] It is also frequently possible to effect considerable savings on finishing operations as compared to other methods of deposition. As opposed to electroplating or dipping, sprayed metal can be applied to local areas without the necessity of shielding. Large castings can be conveniently sprayed after installation.

While sprayed surfaces have given excellent results as concerns wear resistance on bearings and packing surfaces of shafts and other mechanical parts submitted to wear or abrasion, there are limitations to its use for this purpose. As already noted, the material tends to be porous, consequently it has a reduced tensile strength and impact resistance, particularly as concerns resistance to point impact. It normally cannot be used on machine parts where it is desired to build up a sharp edge[7] although as experience in spray gun operation increases, some of these limitations are minimized.

Emphasis has been placed on development of new applications or new component metal parts made possible by the spraying process rather than its more frequent use simply for re-building or maintenance. This treatment appeared logical in view of current development work in which the process has been successfully adapted to a wide range of new uses. However, as is usual in such periods, it is advisable to contact concerns[8] that market equipment used in the spraying process and are responsible for its successful operation.

Hot Dipped Coatings—Metal coating by hot dipping processes is particularly adapted to use with gray iron castings. Essentially the process consists in simple immersion of a clean casting in a molten metal bath of the desired composition. Intricate or complicated casting shapes normally do not constitute a problem, and variation in size is easily taken care of by varying the time of immersion of the part in the bath. Special cleaning processes or use of fluxes are sometimes necessary for optimum results

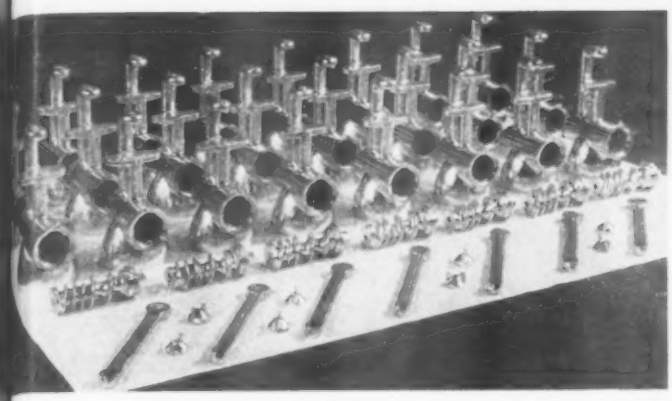


Fig. 5—Gray iron parts for mincer tinned after preparation by the chloride method

before dipping the castings, but cleaning can usually be greatly simplified in operations such as galvanizing.

Tin (Tinning)—The tinning process as applied to gray iron deserves special consideration. Besides providing a surface on castings highly corrosion resistant to the atmosphere and to various types of foodstuffs, and facilitating assembly by soldering and sweating, the surface layer of tin is also essential in effectively bonding bearing metals to a gray iron or steel base. Incidentally, tests have shown gray iron to possess particular virtue as a backing material for bearings.[14] It is significant from a commercial viewpoint that, in addition to a proprietary cleaning process now widely used to prepare gray iron for tinning, new developments,[11, 12] have demonstrated that several alternate methods exist that solve previous difficulties associated with tinning gray iron by dipping or wiping. All yield adherent, smooth, continuous coatings similar in quality to hot-dipped tin coatings on mild steel.

Proprietary methods of preparing the machine surface of gray iron castings for tinning have been widely adopted, of which the Kolene process is a common one. This process usually involves immersion of the casting in catalyzed molten salts at 820-950° F, plus a sequence of oxidation and reduction cycles, actuated by reversing an imposed electric current between the casting and the steel tank. The end effect is normally to oxidize out graphite flakes and produce a ferrite surface adapted to tinning. When this prepared surface is subsequently tinned and babbitted, tests have shown the cast-iron-backed bearings to equal or surpass other types of metal-backed or tri-metal bearings.[14] The process is also employed in preparing the surface of gray iron for electroplating tin and for brazing. Other proprietary methods have appeared on the market.[17]

The improved tinning methods brought out by the Tin Research Institute of Great Britain also depend on immersing the gray iron casting in fused salts. Two types of fused salts can be employed—chlorides or nitrates. In the chloride treatment, the castings are mechanically cleaned, immersed in a fused salt bath (82 per cent $ZnCl_2$, 18 per cent Na Cl) at 300-350° C (572-662° F) and held for 20 to 40 seconds after the solidified salts melt from the casting surface, immersed for at least three to five minutes in a molten tin bath held at 300° C (572° F), then drained and cooled either in air or in paraffin oil. The chloride method gives very adherent coats on properly cleaned castings. For example, white-metal-lined bearings preliminarily tinned by the chloride method gave adhesion values of 4400-6160 psi.

The chloride method is also used for "wiping on" tin. In this operation cleaned castings are coated with an aqueous chloride flux heated to 270-300° C (518-572° F), the mixture of fused zinc chloride and sodium chloride poured on and washed over the surface for 1-2 minutes, excess chloride removed and molten tin poured on and wiped over the surface to be tinned by means of wire brushes or scrapers.

In the nitrate method, which gives even more adherent coatings, the castings are mechanically cleaned, given a light acid pickle to open up graphite flakes, immersed for 15 minutes in a fused nitrate bath (50 per cent $NaNO_3$, 50 per cent KNO_3) at 350-400° C (662-752° F) to oxidize surface graphite, pickled in 10 per cent hydrofluoric acid to remove scale from the nitrate bath, fluxed in an aqueous solution of the chloride salts, and tinned by immersion for at least three to five minutes in molten tin at 300° C (572° F). Since in the nitrate method, tin actually penetrates the cavities formerly occupied by graphite flakes, very efficient adhesion is obtained; cast iron bearing shells tinned by this method and lined with tin-rich bearing metal (89.5 per cent Sn, 7 per cent Sb, 3.5 per cent Cu) having consistently shown adhesion values of the order of 6600 psi.

In general, of the two latter methods, the nitrate method is preferred as being the most flexible and reliable, and yielding the highest adherence values. However, the chloride method can be satisfactorily used and is definitely preferred for tinning by wiping.

Both the Tin Institute methods and the more widely used proprietary methods eliminate former troubles associated with graphite sludge on the iron surface after pickling, and even appear superior to older more expensive methods which involved electroplating with iron or copper previous to tinning.

Very wide gray iron composition limits, i.e., up to 3.5 per cent total carbon, 2.7 per cent silicon and 1.0 per cent phosphorus, are permissible[15] without any appreciable effect on tinning qualities, which means that superior castability of high carbon equivalent irons can be fully utilized.

The foregoing fused salt methods of preparing gray iron for tinning are being successfully used on a commercial scale and their fuller utilization cannot fail to extend the use of tinned gray iron castings in such applications as bearing shells for engines and generators, as constituents of soldered assemblies, operating parts or containers in food processing equipment, and other applications where an adherent, continuous and protective coating of tin is advantageous. Some of these end uses of tinned gray iron are shown in Figs. 1, 4, 5.

Zinc (Galvanizing)—Zinc coatings are one of the commonest methods of (*Please turn to page* 194)

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Bearing Metals—

NICKEL-ALLOYED BRASS AND BRONZE

Compositions of bronzes for various types of bearing applications are described in this third of a series of articles on nickel-alloyed brass and bronze. Previous articles were presented in the August and October issues

THE bearing bronzes are the most important group tonnage-wise in the nonferrous family of foundry products.

Pure metals such as copper, nickel, tin, lead, iron and aluminum make poor bearing materials, and bearings made of them usually fail to pass the first test of possessing resistance to seizure. The same metals made up of powder and compressed into bearings which possess a predetermined amount of inhomogeneity in the form of holes or "void space," may function successfully in many applications. Successful bearings seem to require a certain amount of "planned inhomogeneity."

It is readily comprehensible then, that lead, graphite or some similar soft, greasy and corrosion-resistant insoluble element needs to be added to cast metals to provide inhomogeneity. Mechanical means such as chill casting or centrifugal casting are used to achieve lead dispersion and matrix density. Metallurgical means in which tin, nickel, antimony, etc. are employed as alloys to control the shape, destination and distribution of the inhomogeneity, or to reinforce the base metal structure, are frequently used in the chill-cast as well as sand-cast products.

It is interesting to observe the progress in conformability and embedability obtainable by increased lead contents, which nickel additions, in turn, aid in maintaining and diffusing. Ingredients that form hard inclusions or gritty corrosion products must be avoided. Alloys that contribute resistance to wear, corrosion, heat, fatigue and impact without adversely effecting the microconstituents or pattern of microscopic inhomogeneity, may be depended upon to produce improvements.

Copper-Nickel-Tin-Lead Bearing Bronzes—Nickel-alloyed bearing bronzes are often made in the lower lead compositions of the "Constructional Bronzes" of Table II in THE FOUNDRY, August 1950, page 86, and the "Pressure Bronzes" of Table I in THE FOUNDRY, October 1950, page 88. Zinc contents in excessive amounts are considered undesirable. Compositions with less than 10 per cent lead are harder and less plastic than their higher lead companions.

High lead contents, especially at lead levels of 10 per cent and up, require tin contents of 5 to 10 per cent, and profit from nickel additions of 2 to 5 per cent, to aid solution in the liquid and dispersion when solid. Table I lists typical compositions. As in tin bronzes, nickel refines the grain size, increases the yield strength, toughens the alloy and disperses the lead. Many years ago, Guertler[1] showed that pure molten copper would dissolve only about 35 per cent of lead but when alloyed with 2½ per cent nickel the solubility in the liquid would be doubled.

Alloys containing 50 to 70 per cent of lead with 2 to 6 per cent nickel, balance copper, are mentioned by Clamer[2] as packing ring materials used for locomotive packing rings many years ago. Tin acts in a manner similar to nickel, and the presence of both elements in suitable amounts is helpful. Since lead is practically insoluble in the solid state, and its aggregation during solidification may cause a "lead sweat," its dispersion is desirable in the casting. Pouring at the lowest possible temperature is helpful.

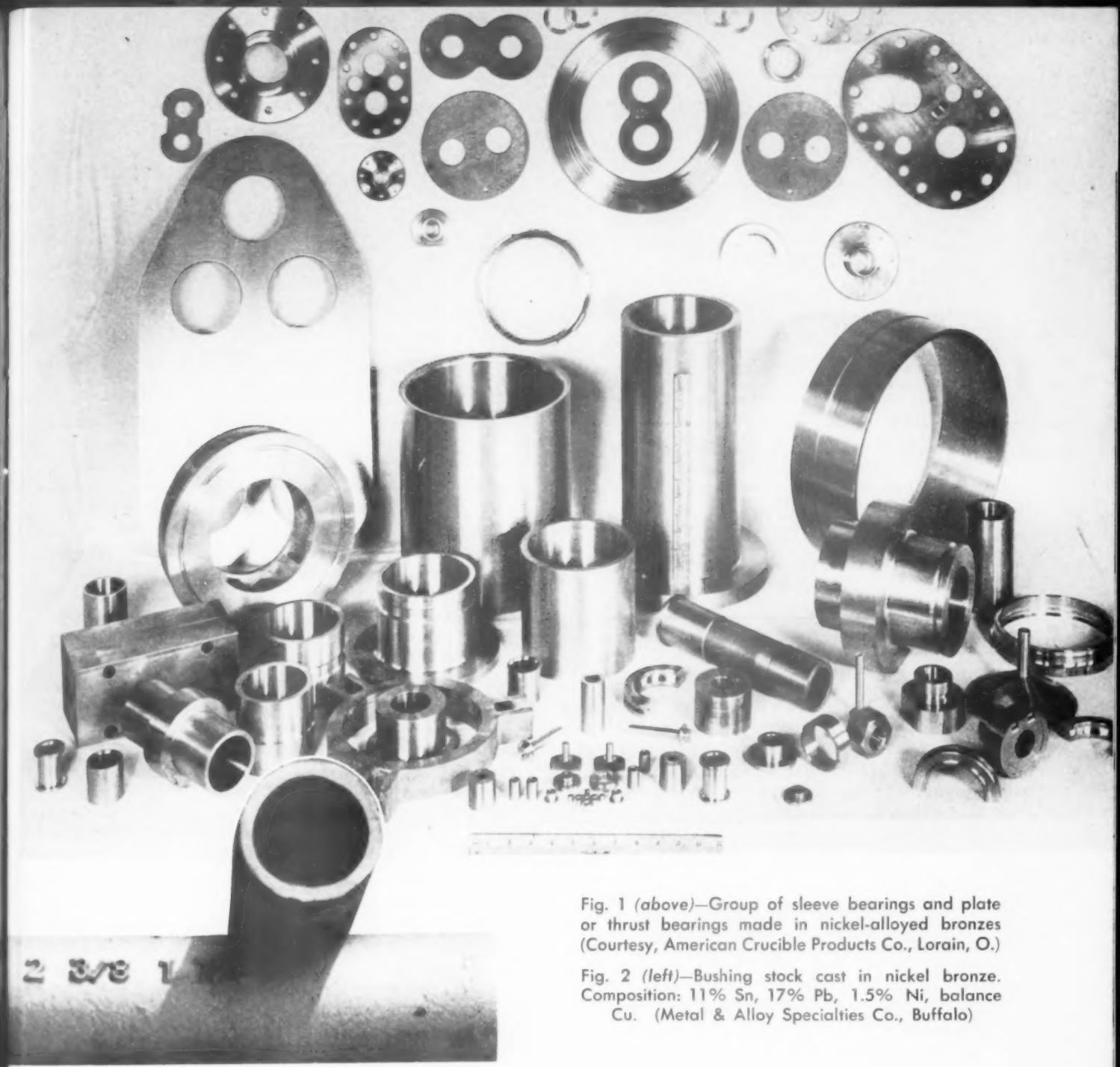


Fig. 1 *(above)*—Group of sleeve bearings and plate or thrust bearings made in nickel-alloyed bronzes (Courtesy, American Crucible Products Co., Lorain, O.)

Fig. 2 *(left)*—Bushing stock cast in nickel bronze. Composition: 11% Sn, 17% Pb, 1.5% Ni, balance Cu. (Metal & Alloy Specialties Co., Buffalo)

Chill casting is useful. Both are aids to rapid freezing. Nickel is active in this same direction and, therefore, beneficial. Table II illustrates a typical case.

The practice of improving the mechanical properties of a bearing bronze with nickel additions of 1½ to 3 per cent is illustrated in compositions 20 and 21 of Table I and also in Table V. Many of the popular bearing bronzes are made in compositions of this type. Correlatively, nickel-tin compositions in which the tin content exceeds 5 per cent and the sum of nickel and tin contents equals or exceeds 10 per cent, as in No. 21 and No. 22 of Table I, can be expected to possess excellent mechanical properties and deliver a correspondingly good performance at a low cost. (Figs. 1 and 2.)

Special nickel alloyed bronzes have been developed for certain bearing applications. Usually a search for higher strength or hardness or fatigue resistance leads to the evolution of these new compositons. Two, shown in Table III, have been used for special service in diesel engines and similar heavy-duty applications. Two of the "railroad" types (A and B), Table IV, are suitable for slow-motion applications requiring high hardness; the third (Type C) for high strength and spring quality at high speed; Types D and E for applications requiring a progressively higher order of plasticity. The application of the lead-free Ni-Vee[3] bronze to steel rolling mill bearings has been mentioned in technical publications.[4]

The capacity of the 5 per cent nickel-5 per cent tin composition to improve its strength and hardness by heat treatment, extends to the bearing metals which, in addition to their copper base, may contain

TABLE I—Bearing Bronzes in Common Use Alloyed with Small Amounts of Nickel

No.	Type	Application	Nickel	Copper	Tin	Lead	Zinc	Phos.	Tensile Strength	Yield Point	Elongation %	Brinell Hardness*
ASTM	Specification B144-49-3A		...	80.00	10.00	10.00	...	...	25,000	12,000	8	..
20	High strength	Bushings, bearings	1.50	78.50	10.00	10.00	0.50 max	0.04	38,000	24,000	15	80
21	Moderate strength	General purpose, bushings, bearings	2.50	80.00	7.50	10.00	0.50 max	0.04	31,000	18,000	10	75
22	Good strength—heat treatable	General purpose, bushings, bearings	5.00	Bal.	5.00	10.00	1.00 max	0.02 max	35,000	20,000	10	80
23	High strength—(No. 22 heat treated)(a)	Wear resisting, bushings, bearings	5.00	Bal.	5.00	10.00	1.00 max	0.02 max	40,000	30,000	5	110
24	Soft, high lead	Conformability, large parts, soft steels and alloys, bushings, bearings	1.00	76.00	6.00	16.00	1.00	0.02	29,000	16,000	18	60
25	Soft, high lead	Conformability, large parts, soft steels and alloys, bushings, bearings	1.00	73.00	6.00	20.00	1.00 max	0.02	28,000	16,000	12	58
26	Strong, high lead heat treatable	Conformability, large parts, bushings, bearings	5.00	Bal.	5.00	20.00	1.00 max	0.02	28,000	16,000	15	70
27	High strength (No. 26 heat treated)(a)	Conformability, wear resistant, bushings, bearings	5.00	Bal.	5.00	20.00	1.00 max	0.02	35,000	25,000	5	90
28	Very soft	Lightly leaded, bushings, bearings	1.50	63.50	5.00	30.00	0.50 max	0.01 max	25,000	15,000	9	48

(a) Heat treatment—5 to 10 hours at 550° F, air cool
* Brinell hardness obtained with 10 mm ball at 1000 Kg load

TABLE II—Mechanical Properties of Nickel Alloyed Bearing Bronzes

Tests from Chill Cast Solids 2½" diam

Mark	Chemical Composition % Cu	Sn	Pb	Zn	Ni	Yield Point 0.5% Extension psi	Tensile Strength psi	Elongation %	Brinell Hardness 1000 kg
1A	Bal.	6	10	1	.	19,500	29,400	7.0	72.0
1B	Bal.	6	10	1	2	26,200	33,250	5.0	87.0
2A	Bal.	5–6	20	0.5	.	16,850	27,000	12.0	62.0
2B	Bal.	5–6	20	0.5	2	20,800	29,000	7.0	73.0

lead in amounts up to 30 per cent. As in all of the tin bronzes, nickel strengthens the alloy. When combined with tin, as in the Ni-Vee series (Table IV, Nos. 3 and 4), the high "as cast" properties can be substantially increased by an appropriate heat treatment while maintaining the desirable characteristics of the lead content needed for the bearing application. The excellent "as cast" properties of these alloys are susceptible to improvement by annealing them for 5 to 10 hours at 550°F. An increase in yield strength and tensile or compressive strength of 50 per cent or more may be confidently expected. The properties of several alloys of the bearing metal type which have been processed through this heat treatment are shown in Tables I and V.

Table VI shows that the properties of a high lead (17 per cent lead, 5 per cent tin and 5 per cent nickel) type of bronze, when heat treated, are superior to those obtained with the traditional 80 copper, 10 tin, 10 lead "as cast" bearing alloy. The 10 per cent lead nickel-tin alloy (No. 23 in Table I) shows, in turn, a substantial improvement over its untreated companion (No. 22), and No. 22 is equal to the best of the group. Similar comments apply to the 20 per cent lead nickel-tin compositions Nos. 26 and 27 of Table I. Refinements in heat treatment can be expected to further improve the properties listed.

These results for the heat treated materials are based on well known metallurgical principles which are founded on the fact that nickel and tin form a constituent which is completely soluble in the liquid metal but possesses a limited solubility in the solidified material. Some portion of the nickel-tin component precipitates in an extremely fine, submicroscopic shower during solidification, lending the resulting casting enhanced properties in the cast condition. By heating such castings at about 550°F, an additional precipitation of the nickel-tin constituent occurs, leading to a desirable increase in strength and hardness.

Since lead becomes liquid at 621°F and, in general, exists in microscopic particles in the solidified casting, it is undesirable to invite fusion and flow of this constituent by exposure to temperatures above 600°F. The low temperature anneal at 550°F avoids this risk and actuates the precipitation of that portion of the nickel-tin component that remains in solution after solidification. This treatment, then, is considered best for the lead-containing alloys.

Nickel-Antimony Bearing Bronzes—Recently several nickel-antimony-lead bearing bronzes have been developed, principally in Canada. One (Type H, Table VII) containing 10 per cent lead, 7½ per cent antimony, balance copper, uses 2 per cent nickel to build up its hardness to make it more suitable for the gear bronze type of application while retaining its frictional bearing types of application. Another, (Type W, Table VII) 10 per cent lead, 1 per cent antimony, copper base alloy, produced optimum strength and elongation properties at 8 per cent nickel. Work by Eash[5] at the Bayonne Laboratory of the International Nickel Co. showed that the resistance to wear was also greatest at this nickel content (Fig. 3). The best pouring temperature was 2225°F. Sand cast surfaces offered a greater resistance to wear than chill cast surfaces (Fig. 4). This composition is recommended for light bearing loads because its strength is in the 20,000 psi range.

If 2 per cent tin is included in composition W of Table VII, the tensile and yield strengths increase substantially (Composition N) and become comparable to those for the common 80 copper, 10 tin and 10 lead alloy. These alloys should possess plasticity and "conformability," typical of the high-lead types of bearing bronzes. They properly belong in the family of materials classified as leaded bearing bronzes. The nickel-antimony leaded bronzes enjoy the advantage of reducing or eliminating tin as an essential constituent of the composition at a considerable saving in cost.

Babbitts, Backed Bearings, Special Products—Babbitts, as a lining material for bearings, are an excellent means for providing (*Please turn to page* 211)

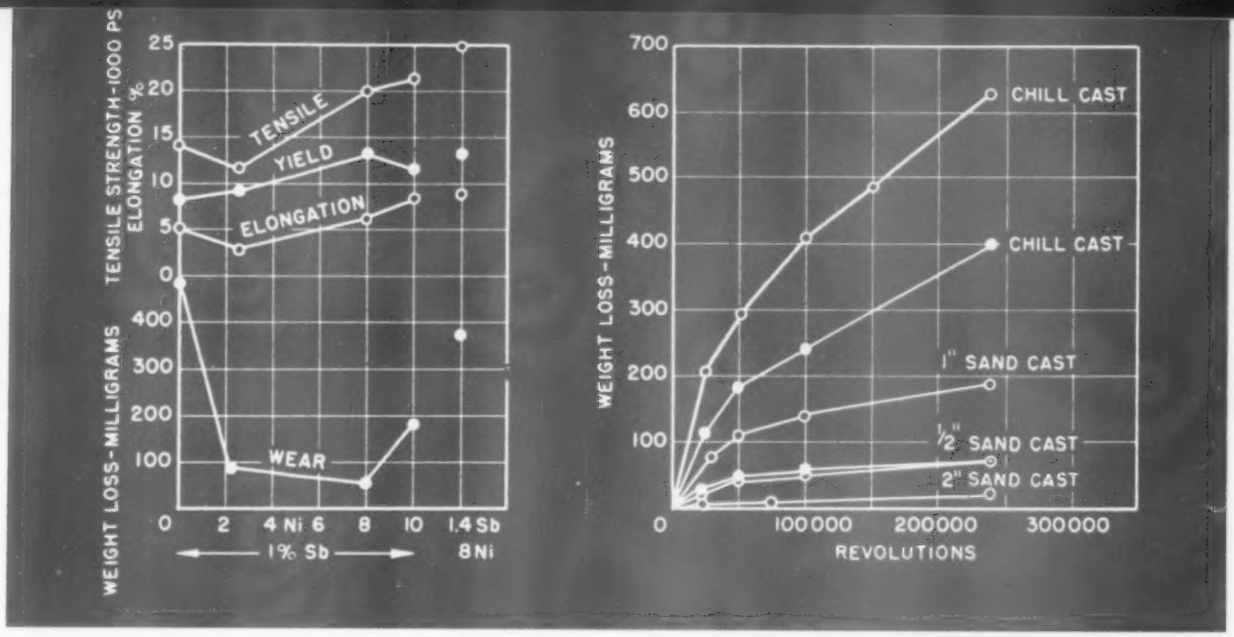


Fig. 3—Effect of nickel on wear and mechanical properties of a 10 per cent lead-copper alloy

Fig. 4—Effect of chill and section on wear of copper alloy containing 10% Pb, 8% Ni, 1% Sb

TABLE III—Special Compositions for Diesel Engine Service

Diesel Engine Service Type	Copper	Nickel	Tin	Lead	Zinc	Form	Tensile Strength	Yield Point	Elongation	Brinell Hardness	Application
N	Bal.	3.0	7.5	..	2.0	Sand cast	48,000	20,000	35	60	Toughness and strength for piston pin, wrist pin bushings. Also backing for lined bearings.
						Chill cast	55,000	22,000	30	80	
Nickel silver	Bal.	20.0	2.5	3.0	6.0	Chill cast	55,000	22,000	20	80	As above, with plated pins.

TABLE IV—Nickel Alloyed Bearing Metal Compositions for Railroad Applications

Type	Copper	Tin	Lead	Zinc	Nickel	Tensile Strength psi	Yield Point psi (0.5 offset)	Brinell Hardness (500 Kg)	Pouring Temperature °F
A—Hard-wearing surfaces	Bal.	8.0	10.5	0.75	1.00	30,500	21,150	74	2,050
B—Wear-resistant, moderately hard	Bal.	7.5	12.5	1.25	1.25	30,500	19,050	61	1,900
C—Packing rings (steam) (Hi Str. uses)	Bal.	5.0	1.0	5.0	5.0	48,000	23,000	86	2,250
D—General purpose & lined bearings	Bal.	7.0	19.0	1.25	1.75	29,000	17,000	65	2,050
E—Soft—general purpose—plastic	Bal.	3.5	25.0	1.25	1.50	22,000	13,000	55	1,950

TABLE V—Properties of "As Cast" and Heat Treated Nickel Tin Bearing Bronzes

No.	Copper	Tin	Nickel	Lead	Zinc	Tensile Strength psi	Yield Strength psi	Elongation in 2 in.	Brinell Hardness (500 Kg)
1	82	6.5	1.0	10	0.50	30,000	16,000	20	55
2	80	6.5	3.5	10	0.50	34,000	20,000	10	70
		(5% Nickel—5% Tin type)							
3	80	5.0	5.0	10	0.50	32,000	22,000	8	75
4	Same as No. 3, aged 10 hr at 575°F					42,000	38,000	3	90

TABLE VI—Properties of Leaded Nickel Tin Bearing Bronze in Compression

Copper, 60-65%—Nickel, 5-6%—Tin, 5-6%—Zinc, 9-11%—Lead, 17-19%

Condition	Proportional Limit psi	10% Offset psi	20% Offset psi	0.5% Deformation Under Load psi	Vickers Hardness 20 Kg Load
"As Cast"	11,000	15,500	16,500	17,200	77
Aged, 575° F, 4 hr	14,000	22,300	24,200	24,300	92
Aged, 575° F, 10 hr	15,500	27,500	30,500	30,500	111
80-10-10* "As Cast"	14,000	18,000	20,000	21,000	75

* 80 per cent copper, 10 per cent tin, 10 per cent lead

TABLE VII — Copper-Base Antimony-Lead Alloys

Type	Copper	Nickel	Tin	Lead	Antimony	Form	Tensile strength	Yield Point	Elongation	Brinell Hardness	Application
H	Bal.	2.0	..	10.0	7.5	sand or chill cast	20,000	13,000	6		Low strength
W	Bal.	8.0	..	10.0	1.0	sand cast					At light loads, will out-wear 10% tin—10% lead—Bal. copper bearing alloys
N	Bal.	8.0	2.0	10.0	1.0	sand cast	25,000	18,000	5		Higher strengths—comparable to 80-10-10—for heavier loads than W

TABLE VIII*—Cadmium and Aluminum-Base Bearing Alloys

Type	Nickel	Cadmium	Tin	Copper	Aluminum	Tensile Strength psi at 80° F	Tensile Strength psi at 575° F	Brinell Hardness 80° F	Brinell Hardness 575° F
1.5% Ni-Cd	1.5	Bal.	..	..	..	16,400	600	33	1.8
3.0 Ni-Cd	3.0	Bal.	..	..	..	22,900	700	48	1.9
Alco 750 series	1.0	..	6.5	1.0	Bal.	20,000	...	45	..

* *Engineering Metals and Their Alloys*, Carl H. Samans, MacMillan & Co., New York, 1949.

Permanent Mold Casting

OF ALUMINUM ENGINE BLOCKS

FOR THE last five years Progress Pattern & Foundry Co., Saint Paul, has been producing aluminum and aluminum alloy permanent mold castings. Utilizing 14 specially built tilting machines (Fig. 2), its production has ranged from castings weighing less than an ounce to castings of 20 pounds or more.

A recent application of these facilities is the production of a twin cylinder water-cooled engine block (Fig. 5). The first step in making the mold for this casting was consultation with the customer's engineering staff. The requirements of the engine block were completely analyzed, to determine what dimensional factors were to be maintained, to determine what metal sections were required, and to assure that all conditions necessary to a successful casting operation would be satisfied.

After the preliminary discussion it was decided to make a model of the mold to determine the workability of the die and the mechanisms for withdrawing the cores, and their possible effect on the thermal balance of the mold, as well as to uncover any special problems presented by the design of the casting. This was done because of the intricate nature of the water-cooled engine block, although this precaution is not required for simpler castings.

When the model of the mold was completed a plaster casting was poured to determine: (1) The metal sections, deciding whether or not they were too light or too heavy for successful casting; (2) if the partings of the mold were correct; (3) if the actuating mechanisms of the core draws functioned properly; (4) if the metal thickness of the mold itself was such as to provide proper (*Please turn to page* 152)

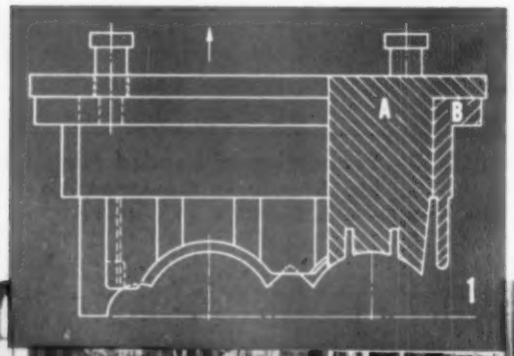
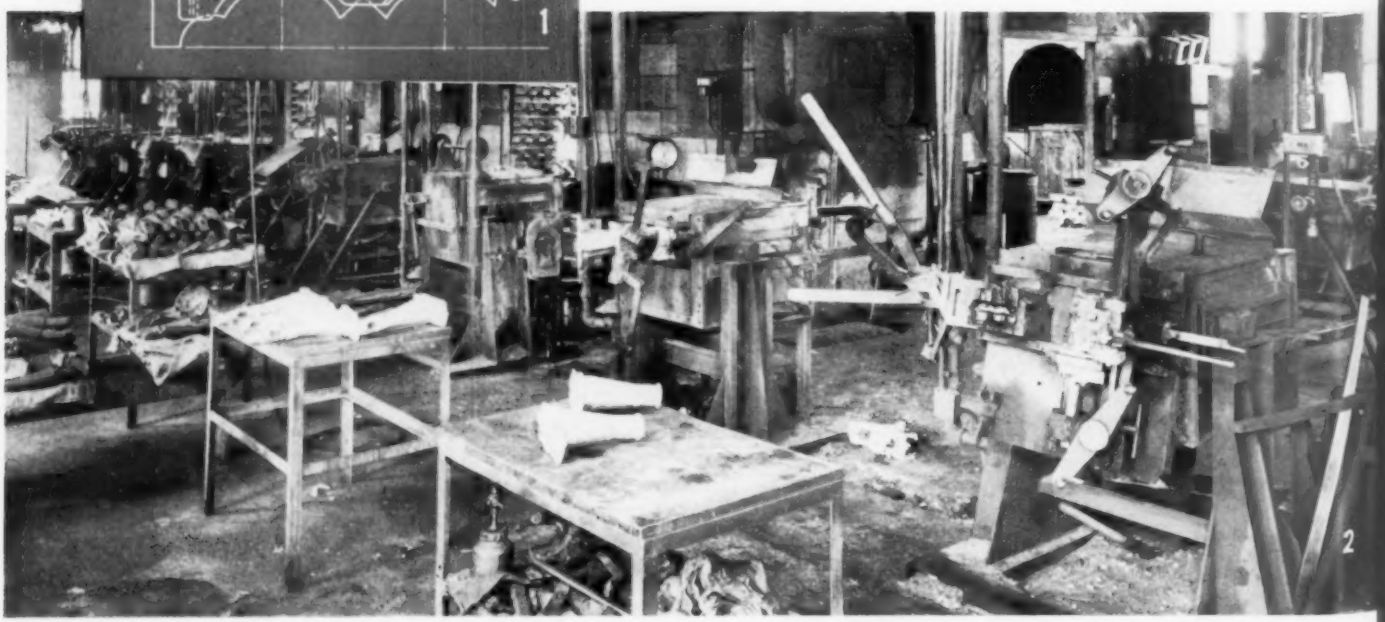


Fig. 1—Details of exhaust core (A) and water chamber core (B) of water-cooled engine block

Fig. 2—Battery of tilting machines employed by Progress Pattern & Foundry Co., St. Paul



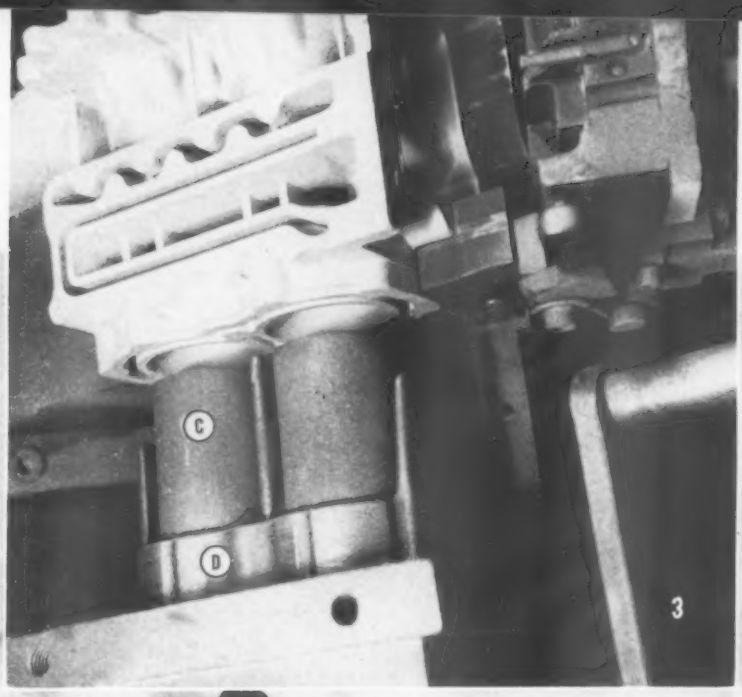


Fig. 3—Cylinder bore cores (C) and water chamber core (D)

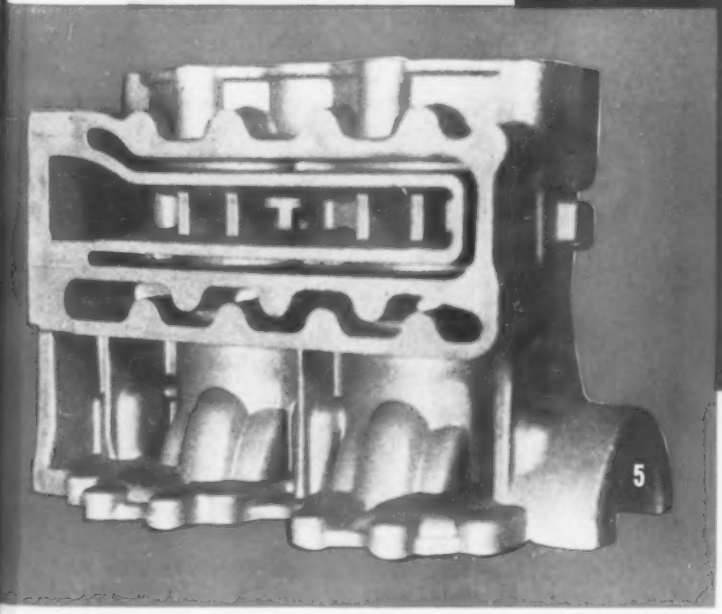


Fig. 4—Cylinder cores and water jacket core

Fig. 5—Twin cylinder water-cooled engine block

Development and Evaluation of

CAST TURBINE

The practicability of casting gas turbine rotors, rather than forging them, has been demonstrated by investigations performed by the Massachusetts Institute of Technology for the U.S. Navy's Bureau of Ships. Production methods and properties of the cast rotors are described here

THE standard method of fabricating gas turbine rotors and disks by forging and machining heat-resistant alloys is time consuming and costly. Most heat-resistant alloys are difficult to forge and machine. Few hammers or presses are of sufficiently high capacity to adequately handle these alloys in the required sizes. Any development which might relieve this situation and possibly provide a higher rate of production of satisfactory rotors and disks would be of great importance.

Since cast alloys have shown greater strength at high temperatures than forgings of similar compositions, it was logical to investigate the usefulness of cast turbine rotors and disks. In addition, the use of lower alloy materials in the cast condition appeared to be a promising possibility for service at high temperatures.

It has been shown frequently that castings generally exhibit directional properties and poor reproducibility of results due to lack of structural control as a consequence of poor casting control. The development of a method to attain close structural control, especially grain size and shape, was a prime consideration of this research program. Various cooling rates could be achieved by varying the mold material, the mold temperature, the metal pouring temperature and the pouring rate. By this means not only grain size but grain shape and direction of solidification could be varied and, it was hoped, reproduced. Since the alloy chosen for this research, N-155, is heat treatable within limits, the effect of heat treating variables also was considered.

Preliminary Work With Cast Ingots—Alloy N-155 was chosen for this investigation because a large amount of data were already available on forged bar stock, forged disks and precision cast test bars of this material.[1, 2, 3, 4, 5] The nominal composition of the alloy used is: Ni 30.0 per cent, Cr 20.0 per cent, Co 20.0 per cent, Mo 3.0 per cent, W 2.2 per cent, Cb 1.3 per cent, Mn 1.5 per cent, C 0.15 to 0.30 per cent, Fe balance.

Melting was by means of induction with the power supplied by a motor-generator unit rated at 64 kw and 1920 cycles per second. The heats ranged from about 20 to 40 pounds. Pouring temperatures were measured accurately in every instance, by means of a calibrated tungsten-molybdenum thermocouple enclosed in a quartz tube for protection.[6]

To obtain various cooling rates which would result in a range of grain sizes and grain shapes, two mold materials of widely differing heat conductivity were selected for the early experiments. These same materials were used throughout the program and proved entirely suitable to obtain the desired structures. Electrode graphite was selected as the high heat conductivity material since it could be machined readily. The life of the graphite was good (generally 20 to 30 heats per mold) and little damage was incurred either in handling or in casting.

Ransome & Randolph investment Co. IC-711-G1

Fig. 1 — Illustrating range in grain size and type in test ingots cast. 1A (left) — Metal

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ROTORS

was selected as the low conductivity material. It was tried both with and without a precoat, but because of precoat breakdown in these large flasks, the precoating technique was discarded. Resulting surfaces were very good, nevertheless.

To determine the metal and mold temperature conditions to produce the desired range of grain structures and grain sizes, a series of ordinary ingot shapes were cast, sectioned, and macroetched both longitudinally and on the cross section. The melting practice, composition control, temperature determinations and general handling practice were established by this early series of ingots. Some of the ingots were cut up to provide both cold tensile and 1500°F stress rupture bars to obtain preliminary test data.

It was determined that three general types of structures could be produced at will: (a) columnar of varying fineness; (b) fine grained equi-axed; (c) coarse grained equi-axed.

The columnar structures are those in which the grains are considerably longer than they are thick, with the long direction approximately perpendicular to the mold wall. Fine grained equi-axed structures are those in which the grains are appoximately equi-dimensional and in which there are at least fifty grains per cross section of a ¼-in. diameter test bar. Coarse grained equi-axed structures are those in which the grains are approximately equi-dimensional and in which there are no more than five grains, but as few as one grain, or a portion of one grain, per cross section of a ¼-in. diameter test bar, cut out from the casting.

From these first ingot castings the following important control items were determined:

1. Carbon content must be closely controlled to maintain certain minimum room temperature tensile or 1500° F (815° C) rupture values.

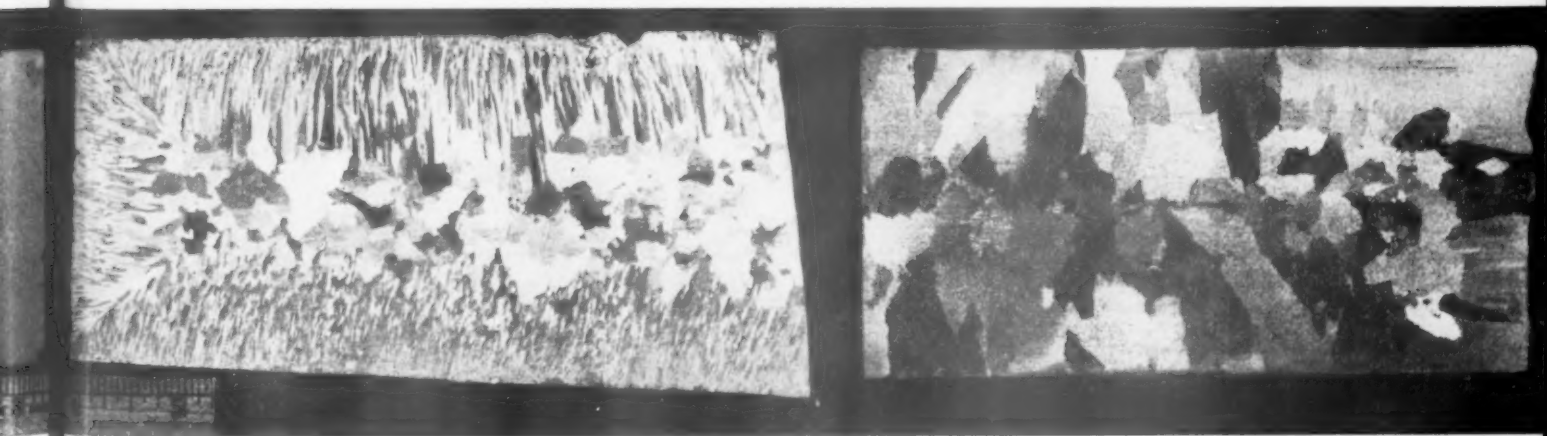
2. The metal pouring temperature must be closely controlled and known accurately at the instant of pouring. This definitely means thermocouple control. A change of 50° C in the metal pouring temperature will change the structure of the casting to a very great degree.

3. The mold preheat temperature is much less important. For example, a change in the preheat temperature of a graphite mold from 25° C to 600° C (77° to 1110° F) had very little effect on the grain size and the position of the columnar—equi-axed transition line. A change of several hundred degrees also had very little effect on the structure of the investment mold ingot structure. These mold temperature differences do, however, have an effect on the ability of the metal to fill out the casting cavity where sharpness of detail may be important in commercial castings.

4. It was found that to obtain optimum yield and tensile strength, as well as maximum rupture life, the alloy must be solution-treated and aged, according to treatments to be discussed later.

The minor importance of mold temperature for a given material greatly simplified the selection and use of refractories.

Subsequent to this initial effort a second series of ingots of the same size were cast; however, now all of the above variables were observed closely and exact structures were produced for mechanical test purposes. The range of grain sizes and types are illustrated in Fig. 1, and range from a fine equi-axed to a coarse equi-axed grain. Columnar structures occupying the entire cross-section to the usual mix-



poured at 1500°C into graphite mold preheated to 330°C. 1B (center)—Metal poured at 1600°C into graphite mold at 760°C. 1C (right)—Metal at 1600°C, into investment mold at 25°C

ture of structures as shown in Fig. 1B were also produced. Any variation over this entire range could be produced.

From such structures, test bars were removed to check the tensile and stress rupture properties in both the as-cast and aged condition, and after solution treating at 2260° F (1235°C)—½ hour—water quench and aging 24 hours at 1350°F (732° C). Bar graphs in Figs. 2 through 5 show the test results.

It should be noted that the values in Figs. 2 through 5 are average values obtained from at least three tests. There was little variation in the data for each group, and for the sake of brevity the individual values are omitted.

On the basis of the stress rupture tests conducted at a temperature of 1500° F (815° C) and a stress of 20,000 psi, the columnar structure is definitely superior to the other structures of similar carbon content for the as-cast and aged condition. The fine-grained equi-axed structures show higher rupture values than do the coarse grained equi-axed structures. This comparison is based on tests of ¼-in.-diameter test bars where the cross section of coarse-grained specimens almost always contained from one to three or four grains or parts of grains. It had previously been shown that the coarser grained structures in alloys of the N-155 type are stronger at 1500° F (815° C) in stress rupture than finer grained structures.[1] Obviously, relative grain orientation effects become of great importance in the control of the resultant mechanical properties when only one to four grains occupy the entire cross section. Accordingly, it is incorrect to state that the coarse-grained equi-axed structures would necessarily be weaker in large parts operating at 1500° F (815° C) where the large grains have an opportunity to behave according to the more average conditions of random orientation, since even in such coarse condition there are restraining neighbor grains. The only real test of the suitability or lack of suitability of the very coarse-grained equi-axed structure would be a hot spin or service test of the cast disk or rotor.

In this series, solution treatment followed by aging approximately doubles the rupture life of the columnar and the fine-grained equi-axed test bars, while it more than quadruples the rupture life of the coarse-grained equi-axed bars. It is interesting to note that such a treatment increases the rupture life of the low-carbon columnar specimens by a factor of about 10, at 1500° F (815° C).

Examination of the hot ductility data in Fig. 3 shows that the fine-grained equi-axed structure has the lowest ductility. This is true for the as-cast and aged as well as for the solution-treated and aged specimens. The standard carbon columnar structure again shows high ductility (probably due to orientation effects).

The effect of solution treatment is to lower the ductility. There are almost no exceptions to this behavior. The decrease in ductility is greatest for the low-carbon columnar structure.

The relatively severe embrittlement of the low-carbon N-155 structure with solution treatment and aging made the higher carbon N-155 composition much more attractive since it is very much stronger and does not become as embrittled. As long as welding is not a limiting factor, the higher carbon content seems highly desirable (up to about 0.30 per cent

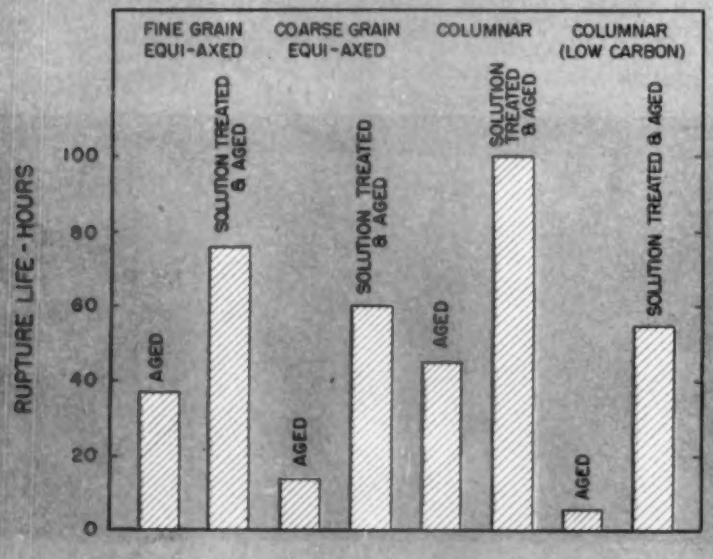


Fig. 2—Average rupture life at 20,000 psi and at 1500°F for various grain structures

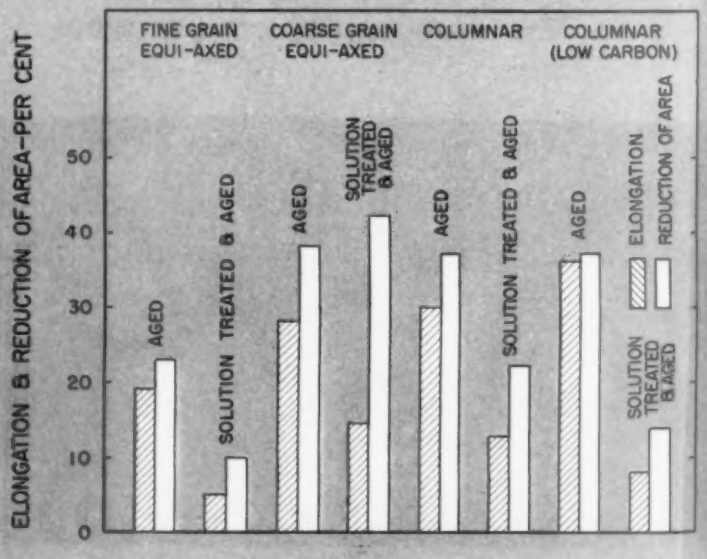


Fig. 3—Average hot ductility at 1500°F and at 20,000 psi for various structures

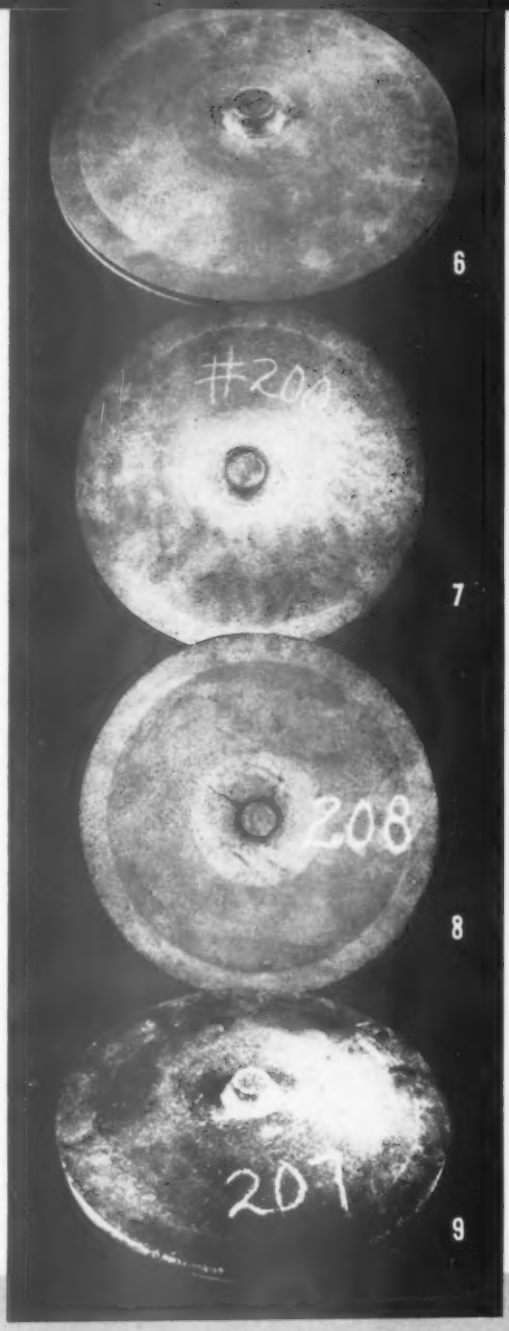


Fig. 6 — Graphite mold, 538°C. Metal temperature 1460°C. Sillimanite (−200 mesh) mold wash. Sand blasted

Fig. 7—Graphite mold, 25°C. Metal temperature 1530°C. Thermolith layer plus black mold wash. Sand blasted

Fig. 8—Investment mold at 25°C. No precoat used. Metal temperature 1495°C. Rotor sand blasted

Fig. 9—Investment mold at approximately 100°C. No precoat. Metal temperature 1490°C. Without sand blast

carbon, at least).

The cold tensile data, unfortunately, are based on fewer specimens than the stress rupture data, the reason being that some of the specimens were overheated during heat treatment due to faulty furnace control. Consequently, the only available data for fine-grained equi-axed specimens are too questionable for inclusion in this report.

From Figs. 4 and 5, it may be seen that for the as-cast and aged specimens, tensile strength and yield strength—as well as ductility—are higher for the columnar specimens than for these of the coarse-grained equi-axed structures. After solution treatment the ductility suffers considerably in all cases as the bar graphs show. In Fig. 4 the tensile strength of the solution treated (0.25 per cent carbon content) columnar structure is lower than that of the coarse-grained equi-axed and low-carbon columnar structures. This is probably not an accurate figure, but may be the result of overheating during solution treatment. This is borne out when it is noted in a comparison of similar structures from the cast disks that the tensile and yield strengths of the columnar structure are higher than those of the partly equi-axed structure (see Table II).

It may be concluded that for N-155, a columnar structure is more desirable from the standpoint of stress rupture strength and hot ductility than either

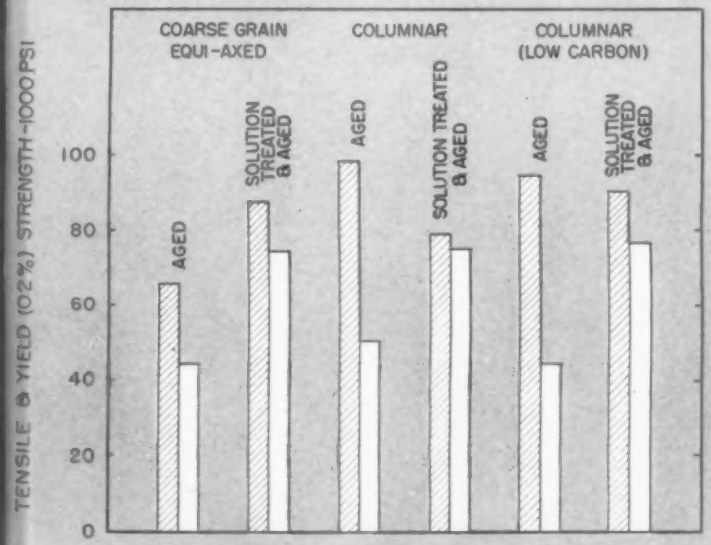


Fig. 4—Room temperature yield strength (0.2%) and tensile strength for various structures

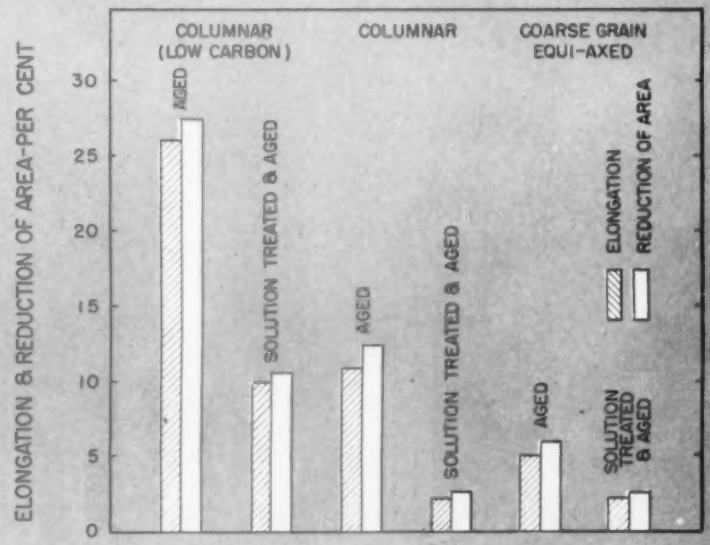


Fig. 5—Relative ductility of various type grain structures at average room temperature

the fine-grained equi-axed or coarse-grained equi-axed structures, assuming all respective ingots to be of approximately the same carbon content and in the as-cast and aged condition. Columnar structures are also superior insofar as their room temperature properties are concerned.

For the solution treated and aged specimens, the high temperature properties of the columnar structure are again better than the properties of the fine and coarse grained equi-axed structures of similar carbon content. The room temperature tests are not really conclusive for this group, although it is indicated by the high strength of the low-carbon columnar specimens that a suitably heat-treated columnar structure would be as good or better than a similarly treated fine or coarse grained equi-axed structure of higher carbon content.

It may also be concluded that correct solution treatment followed by aging improves both the hot and cold strength properties of all the structures and reduces the ductility.

Perhaps the most interesting information obtained in this preliminary research was that the columnar structures were the strongest and the most ductile of the various structures at 1500° F (815° C) as well as the strongest at room temperature. Because the face-centered cubic metals (such as N-155) crystallize in a columnar structure with the (100) plane parallel to the direction of growth, it is logical that the test bars with columnar structures parallel or perpendicular to the test bar axis should show about the same properties. This is a desirable structure for a rotor because it diminishes undesirable directional properties to a minimum, and takes advantage of important preferred grain orientation.

Turbine Rotor Castings (Type B-2 Supercharger Disks)—Based on information obtained from cast ingot structures a series of cast rotors were made to obtain the desired structures. Again tensile and 1500° F stress rupture tests were made to check mechanical properties. Based on these test results, a group of final castings was planned for hot spin testing as the ultimate means of evaluating the structures and to see if cold tensile and 1500° F (815°C) stress rupture values could serve as a guide in the selection of cast wheel materials.

As in the case of the ingots, two different types of molds were used for obtaining different structures, a graphite mold for the columnar and fine-grained equi-axed structures. Centrifugal casting was tried for both types of molds, but was found to be unnecessary in the case of the investment molds because they filled out adequately when poured statically.

A two-piece graphite mold was machined from 14-in.-diameter electrode graphite stock. The shape of the casting is approximately that of a Type B-2 supercharger rotor, the mold being machined about 4 per cent oversize to allow for metal shrinkage.

It was hoped that as-cast structures might be obtained which would require a minimum of conditioning for service. It was found impossible to obtain acceptable surfaces regularly even with the investment practice. The graphite castings were of course considerably worse. Apparently the first metal to strike the graphite mold is chilled and forms a skin which is not remelted by the metal which follows. This results in cold shuts and seams except when the

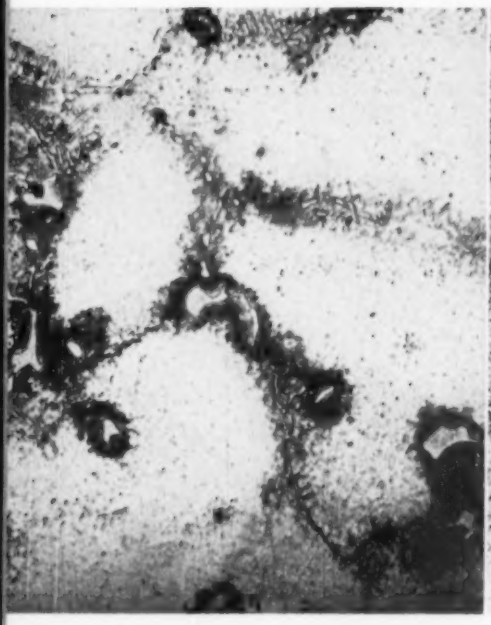


Fig. 16—Fine-grained equi-axed ingot. As cast, aged 25 hr 1350°F. Rupture life 35 hr at 20,000 psi, 1500°F. 500X

Fig. 17 — Fine-grained equi-axed ingot. 2260°F ½ hr, water quenched, aged 24 hr 1350°F. Life 50 hr, 20,000 psi, 1500°F

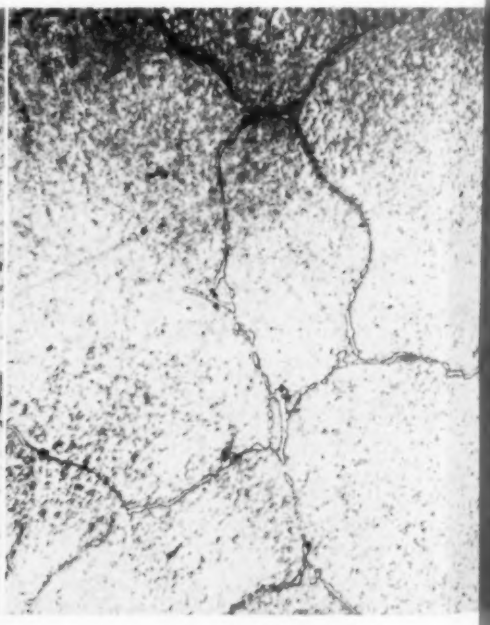


Fig. 18 — Fine-grained equi-axed ingot. 2260°F 2 hr, water quenched, aged 24 hr 1350°F. Life 75 hr, 20,000 psi, 1500°F

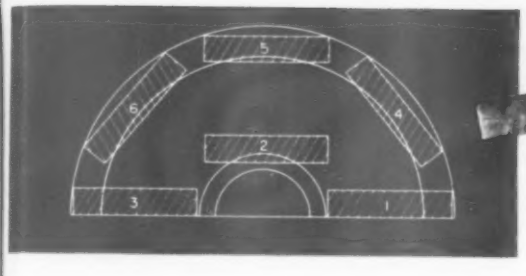


Fig. 10—One half cast wheel showing specimen location for mechanical tests. Nos. 1-6 for aged half, Nos. 7-12 for solution treated and aged half located similarly

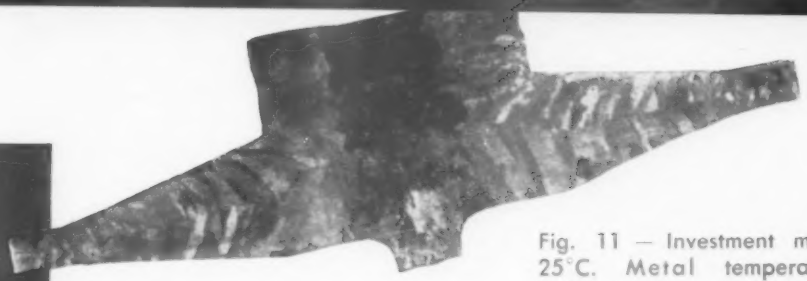


Fig. 11 — Investment mold, 25°C. Metal temperature 1495°C. Coarse-grained equi-axed structure

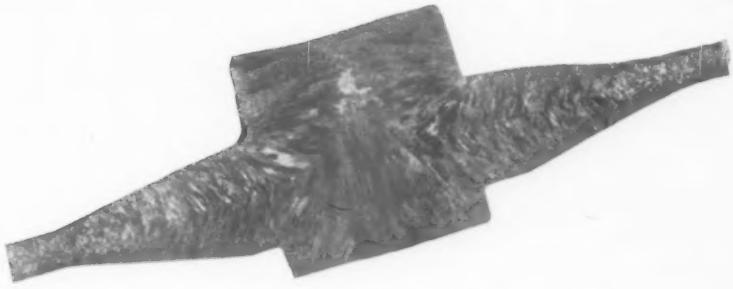


Fig. 12 — Graphite mold, 454°C. Metal temperature 1505°C. Fine-grained equi-axed outer rim, balance columnar

Fig. 13—Graphite mold, 25°C. Metal temperature 1525°C. Columnar structure throughout. Compare with Fig. 12

Fig. 14 — Graphite mold, 538°C. Metal temperature 1485°C. Fine-grained equi-axed rim, balance columnar

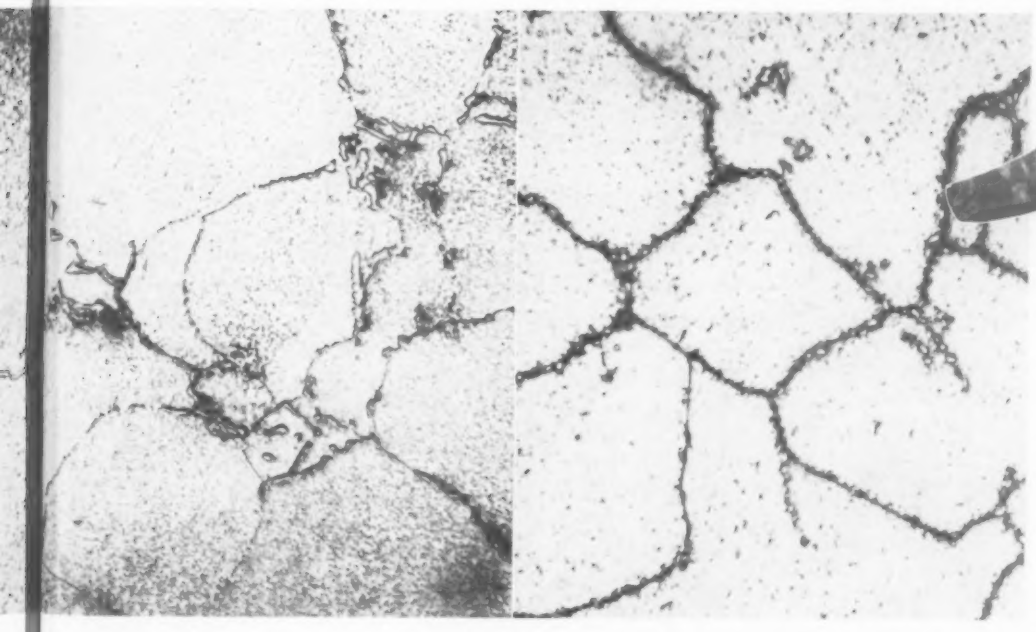


Fig. 19 — Fine-grained equi-axed ingot. 2260°F 4 hr, water quenched, aged 24 hr 1350°F. Life 85 hr, 20,000 psi, 1500°F

Fig. 20 — Fine-grained equi-axed ingot. 2260°F 16 hr, water quenched, aged 24 hr 1350°F. Life 40 hr, 20,000 psi, 1500°F

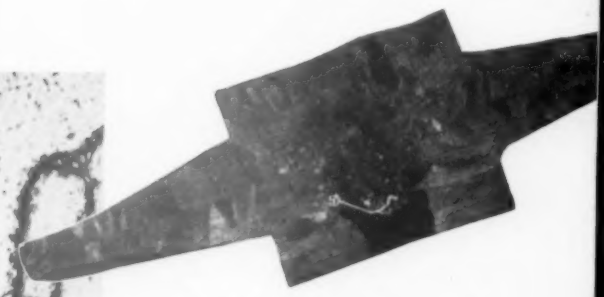


Fig. 15 — Investment mold, 25°C. Metal temperature 1515°C. Coarse-grained equi-axed structure

metal is extremely hot, in which case there is a tendency to burn the mold. To alleviate this condition, several different mold washes were tried. From this work, it appears that a satisfactory wash must have two major characteristics: (a) It must be refractory, but a poor heat conductor so that the first metal splash will not adhere to it. (b) It must bond well to the graphite in order to prevent spalling caused by heat shock and the turbulent action of the metal in the rotating mold. Very thin coatings are of course preferable.

Various mold washes were tried, including −200 mesh sand separated from R & R investment by screening. This latter wash best fulfilled the two requirements stated above and even that was not entirely satisfactory. There are still other washes to be tried since further improvements are highly desirable.

The wash adhered to the graphite extremely well and most of the original wash was still in place when the casting was removed from the mold. However, the insulating effect of the thin wash was insufficient to compensate for the chill effect of the graphite mold, and oxide skin creases on the bottom side of the casting resulted. It was not possible to use washes of greater thickness because of the greater tendency to spall and wash off, and because the added insulation would cause changes in the wheel structure.

The procedure for pouring a centrifugal heat in graphite consisted of the following steps: The mold was sprayed with mold wash and a firebrick hot-top was fastened over the pouring hole prior to preheating the assembly to 1000° F (540° C) in a resistance furnace. A charge of about 15 kg was then melted down in a 17-kg induction furnace while a bottom-pouring transfer ladle was being preheated with an air-gas torch. The stopper rod was 1¼-inch.-diameter graphite rod protected with a ¼-in.-thick fireclay sleeve cemented to it. The rod was inserted in the nozzle seat and tamped lightly with cement to obtain a tight fit.

When the heat was ready to be poured, the hot mold was fastened to the rotating table of the centrifugal casting machine and the cover of the machine bolted in place. The temperature of the metal was checked with a tungsten-molybdenum thermocouple in the furnace to permit temperature adjustment before the molten metal was poured into the ladle. The pouring ladle was then quickly lifted into positon over the centrifugal casting machine and the thermocouple again immersed in the molten alloy. When the desired pouring temperature was reached, stopper rod was pulled out, permitting the rotating mold and hot-top to be filled. Considerable heat was lost in the transfer operation with these small heats,

TABLE 1—Stress Rupture Properties at 1500° F (815° C) and 20,000 psi†

Figure No.	Heat No.	Per Cent Carbon Rim	Per Cent Carbon Hub	Treatment	Rupture Life, Hr**	Per Cent Elong**	Per Cent R of A**	Structure
30	208*	0.19	0.18	Aged 24 hr, 1350° F	15.7	33.5	35.9	Coarse grained equi-axed
31	209	0.28	0.27	Aged 24 hr, 1350° F	68.0	24.6	25.0	Fine grained equi-axed
31	209	0.28	0.27	2 hr, 2200° F air cooled Aged 24 hr, 1350° F	125.4	7.5	7.3	Fine grained equi-axed
32	212	0.25	0.26	Aged 24 hr, 1350° F	104.4	14.5	42.3	Columnar
32	212	0.25	0.26	2 hr, 2200° F air cooled Aged 24 hr, 1350° F	133.0	5.5	12.7	Columnar
33	218	0.26	0.25	Aged 24 hr, 1350° F	388.3	34.0	43.4	Fine grained equi-axed
33	218	0.26	0.25	2 hr, 2200° F air cooled Aged 24 hr, 1350° F	139.0	9.2	15.1	Fine grained equi-axed
34	252	0.30	0.32	Aged 24 hr, 1350° F	22.1	20.1	28.9	Coarse grained equi-axed
34	252	0.30	0.32	2 hr, 2200° F air cooled Aged 24 hr, 1350° F	110.4	3.3	4.8	Coarse grained equi-axed

† From rim of wheel—specimens 4, 5, 6, 10, 11, 12 (see Fig. 10), chosen at random.
* The solution treated half of Heat No. 208 was water rather than air quenched, causing cracks at the rim, hence those specimens were not tested.
** Average values from three tests.

TABLE II—Room Temperature Properties†

Figure No.	Heat No.	Ten Str. psi*	0.2% Offset YS, psi*	YS/ Ten Str	Per Cent Elong*	Per Cent R of A*	Treatment	Structure
30	208	70,830	47,800	.684	11	8.3	Aged 24 hr, 1350° F	Coarse grained equi-axed
30	208	73,800	62,100	.841	7	7.2	2 hr, 2260° F, water quenched. Aged 24 hr, 1350° F	Coarse grained equi-axed
31	209	94,600	56,500	.593	6.7	9.4	Aged 24 hr, 1350° F	Columnar
31	209	113,700	75,800	.668	7.7	9.0	2 hr, 2200° F, air cooled. Aged 24 hr, 1350° F	Columnar
32	212	100,900	57,700	.573	11.0	13.0	Aged 24 hr, 1350° F	Columnar
32	212	119,400	74,900	.628	10.3	11.9	2 hr, 2200° F, air cooled. Aged 24 hr, 1350° F	Columnar
33	218	90,300	50,500	.560	7.0	7.0	Aged 24 hr, 1350° F	Part columnar, part fine grained, equi-axed
33	218	65,600**	59,400**	.917	2.4**	2.3**	2 hr, 2200° F, air cooled. Aged 24 hr, 1350° F	Part columnar, part fine grained, equi-axed
34	252	77,200	54,500	.710	6.0	4.8	Aged 24 hr, 1350° F	Coarse grained equi-axed
34	252	103,500	74,300	.717	6.3	4.9	2 hr, 2200° F, air cooled. Aged 24 hr, 1350° F	Coarse grained equi-axed

† From hub section—specimens 1, 2, 3, 7, 8, 9 (see Fig. 10).
* Average values from three tests.
** Values much lower than might be expected.

and the metal had to be superheated by about 200 degrees above the pouring temperature necessary to obtain the all-columnar structure desired for some of the castings.

Speed of the centrifugal machine during the casting of each rotor generally was either 187 or 330 rpm.

The investment molds required considerable time in preparation, but were easier to pour and control than the graphite ones. The wax pattern was made by centrifugally casting wax into a special highly polished aluminum die cavity of the shape of a Type B-2 supercharger rotor. The wax pattern was then invested on edge in a stainless steel flask, using R & R investment. The pattern was placed on edge so that the entrapment of air bubbles which form as the investment sets would not collect on the underside of the pattern and mar the surface. Some bubbles did collect on the vertical surface, and increased in size as the exothermic setting reaction progressed.

Better results could have been obtained by exhausting air from the investment before pouring it into the flask. A groove was invested in the top surface of the mold concentric with the pouring hole and a hot-top about 6 in. high was invested in a separate flask to fit this groove to make a tight-fitting hot-top.

The mold and hot-top were dewaxed at about 200° F and then baked out at 1500° F (815° C) over a period of about 8 hours. In some of the castings both the flask and hot-top were allowed to cool to room temperature prior to pouring, while in others the hot-top alone was kept at 1500° F (815° C) and placed in position just before pouring while the mold proper was permitted to cool. This latter procedure gave greater assurance of producing sound disks.

Sound wheel castings were readily obtained in the graphite molds; however, in the investment molds, the insulating effect of the hot silica sand coupled with the cooling effect of the air above the hot-top caused a deep-seated pipe in the wheel below the riser. Accordingly, when the molten charge was poured into an investment mold, even a superheated hot-top sleeve did not necessarily prevent pipe formation in the rotor. Furthermore, the separate handling of a superheated hot-top was inconvenient and sometimes resulted in cracking of the hot-top. The use of a very much larger riser and hot-top did not eliminate the damaging pipe area sufficiently and resulted in the use of excessive amounts of metal.

The problem was finally solved satisfactorily by decreasing the hot-top or riser to about 1.5 to 2 in. instead of the usual 4 to 6 in., and adding 1 to 2 kg of Risotherm, a commercial thermite mixture, in the hot-top after pouring the heat. By using up to 2 kg it was possible to decrease the alloy melt from about 17 to 12 or 13 kg. Completely sound castings were obtained in all instances with a minimum of effort. No contamination of the useful part of the wheel casting was noted.

A total of about 50 rotors were cast by the above methods. Figs. 6 through 9 illustrate several of the earlier castings and show the types of surfaces obtained. Five wheels representative of three different grain structures were sectioned and etched. From each of these wheels, 12 (*Please turn to page* 234)

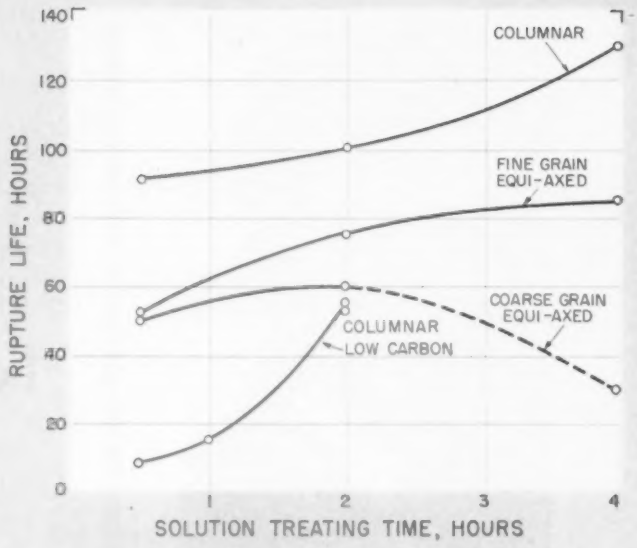


Fig. 21—Rupture life vs solution treating time at 2260°F. Tests at 20,000 psi and 1500°F

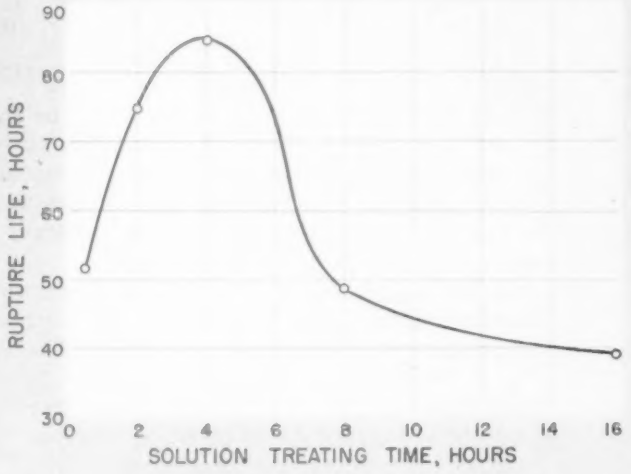


Fig. 22—Effect of solution treating time at 2260°F on rupture life of fine-grained equiaxed structure. Tests at 20,000 psi and 1500°F

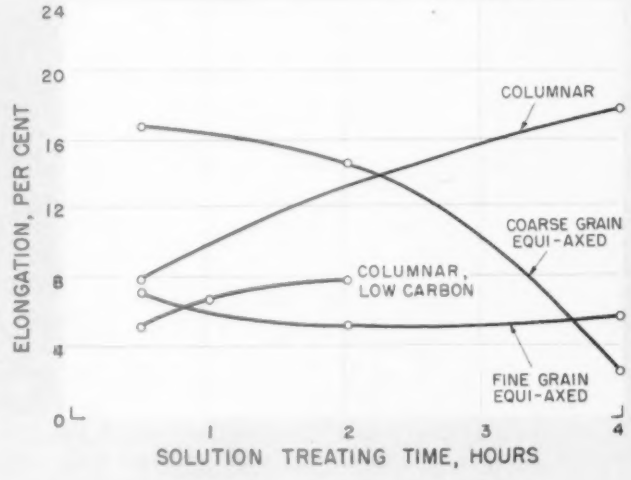


Fig. 23—Elongation vs solution treating time at 2260°F. Tests at 20,000 psi and 1500°F

By COMDR. RICHARD DOUGHTON JR.
Office of Naval Material
Navy Department, Washington

The Military Looks to Industry

This discussion of how the foundry industry can best serve the military in the present emergency was presented by the author at the annual fall meeting of the Steel Founders' Society of America at Hot Springs, Va., Sept. 26

THE SUBJECT, "The Military Looks to Industry," is indeed a broad generalization—one which could permit me to say much about many things. And I can well imagine that the opposite is true also—that industry looks to the military for guidance, for planning, for direction.

First, let me review very briefly the organization of the military in order to establish the position of the departments in the logistic planning. The Joint Chiefs of Staff develop the strategic plans for conduct of military operations. The Chief of Naval Operations, the Army Chief of Staff, and the Chief of Staff, U. S. Air Forces, then promulgate to the technical bureaus, services, and the Air Materiel Command the logistics plans which implement the strategic plans. These bureaus, services, and the AMC are then in a position to compute their requirements to accomplish the assigned missions.

These requirements cover the entire expanse of industrial activity including manpower, equipment and supplies, construction materials and components, industrial equipment, petroleum and services such as power and transportation. The departments then advise the Munitions Board what will be needed and the Munitions Board prepares industrial plans to fill these needs and informs the Joint Chiefs of Staff of the industrial feasibility of its strategic plans. Mobilization planning thus necessarily requires an answer to three questions which connect all the military's requirements: What? How much? and When?

The Munitions Board neither buys nor sells. It does have stockpiling authority and provides for certain critical and strategic materials in the national stockpile but, of course, no one can stockpile castings, per se. Even the Military Departments do not normally purchase many castings directly. We do buy ships and guns and tanks and planes and machine tools—and few of these are even possible without castings, in considerable tonnage. There are, of course, situations in which the departments will buy castings as such, either rough as-cast or finish-machined.

A considerable amount of tank cast armor was procured directly by the Tank and Combat Vehicle Section of Army Ordnance, I believe, and the Navy has long considered that propellers are best scheduled as a government-furnished item for the shipyards. Also, in the course of the big landing craft and destroyer escort programs in 1942-43, primarily for reasons of schedule control, one independent organization acted for the government and placed many contracts directly for castings to be supplied to the building yards, particularly for struts and stern frames, etc. Standard anchors of the larger sizes were likewise procured directly. This type of operation in addition to the advantages of production schedule control obtainable also saved many valuable man-hours which would have otherwise been expended in much duplicate patternmaking.

We have seen several examples of governmental systems which attempted to provide the answers to both industry and the military in the early days of World War II. We began with priorities on nickel and nickel-bearing alloys which soon spread like wildfire to include in rapid succession all steel, all metals, and then everything. We went from the priorities system to allocations to limiting orders; from the Defense Supplies Rating Plan to the Controlled Materials Plan, from OPM to SPAB to WPB, and so on.

America has been engaged in two great wars in our lifetime alone, and in each, time was our early great ally. In both World War I and II, we had two years in which to get ready—two years in which our friends were the direct targets of enemy assaults. Next time—I nearly said *this* time—our buffer will probably not be measured in years.

There are, however, (*Please turn to page* 228)

In investigating methods for introducing zirconium into magnesium, the author reports the best results were achieved through use of zirconium salts. Mechanical properties of the magnesium-zinc-zirconium alloys are described as appreciably better than those of alloys commercially available today

Magnesium Alloys Containing Zirconium

By LT. GEORGE W. ORTON
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METALLURGICAL research on the magnesium-zirconium alloy system was started in 1938 at the Light-Metal Research Laboratories of the I. G. Farbenindustrie, in Bittenfeld.[1] This work was stopped in 1941 when it was decided that zirconium reserves in Germany were so low that commercial alloys could not be produced.

During this period, however, Sauerwald and his coworkers Holub, Eisenreich and Subel contributed significantly to the development of low-alloy magnesium metal systems, and to an understanding of some of the difficulties involved in preparing magnesium-zirconium alloys. They were successful in producing magnesium alloys with up to 0.93 per cent zirconium in solution and alloys that had yield strengths of 25,000 psi, ultimate tensile strengths of 40,000 psi, with elongations of 11 per cent. These properties were obtained in test bars that had been cast and aged.[2]

Magnesium Elektron Ltd., in Great Britain, became interested in magnesium-zirconium alloys, and in 1947 were commercially producing Elektron Z5Z having a typical chemical composition of 0.7 per cent zirconium, 4.5 per cent zinc, balance magnesium, and having typical mechanical properties as follows: 0.1 per cent proof stress of 9.5 tsi, ultimate stress of 16.0 tsi, with an elongation of 7 per cent.[5]

Inasmuch as these properties are as good as or better than commercial casting alloys used at the present time, it was decided to investigate the magnesium-zirconium alloy system at the Air Materiel Command.

Methods and Procedures—All melts were prepared in open steel pots under Dow 310 flux and varied in weight from 15 to 50 pounds. The procedure in general was to melt virgin magnesium ingot to the temperature range 1300-1400°F. Alloying and fluxing were accomplished in this range. The metal was then heated to 1425-1500° F, stirred and held for 5-10 minutes before pouring. Pouring temperatures were varied from 1400-1500° F.

A sulphur-boric acid agent was used to reduce burning subsequently to skimming the 310 flux from the surface of the melt. A sample for chemical analysis was dipped from the surface just prior to pouring.

Mechanical properties were determined from conventionally cast test bars, four in a mold. (See Fig. 12 and 13, AF Technical Report 5246, Foundry Procedures and Test Data of the Wright Field Magnesium Foundry, for test bar pattern.) All values from tensile testing represent average results from at least three test bars, and in the majority of cases the results are from six or more test bars.

Solution heat treatment of all test bars was done in a Lindberg Cyclone furnace in which approximately ½% concentration of SO_2 was maintained. The recorder-controller was a Leeds & Northrop Micromax. The test bars were cooled in still air.

Alloying with Zirconium — Considerable difficulty was encountered in getting a consistent amount of zirconium into solution and in producing clean, sound test bars. Results were erratic. With some melts as much as 0.85 per cent zirconium would be found in solution and with other melts as little as 0.08 per cent zirconium would be found. Furthermore, it was noted that there was a high correlation between the amount of zirconium in solution, the fineness of the grain, and the mechanical properties.

The use of a master alloy was discontinued because the cast bars were usually dirty and generally contained only small amounts of zirconium. This was attributed to the spongy texture of the master alloy that made it ideal for absorbing gases and foreign particles.

Various salts of zirconium were tried as well as metallic zirconium. One melt was prepared by adding particles of zirconium milled from bar stock. These particles had a diameter of approximately 1/64-inch. They were immersed into molten magnesium at 1400° F, the melt heated to 1800° F and held for 1½ hours. During this period the melt was stirred vigorously at 15-minute intervals. It was allowed to cool and poured at 1350° F. An analysis showed that the zirconium content was only 0.14 per cent.

The best results in alloying magnesium with zirconium were obtained by adding salts of zirconium. Sodium zirconium fluoride was tried, but it did not prove to be as good as zirconium chloride. Commercially pure dense zirconium chloride and a mixture containing approximately 50 per cent zirconium chloride, 25 per cent sodium chloride, and 25 per cent potassium chloride were both used with equal success.

The salt was thoroughly (*Please turn to page* 156)

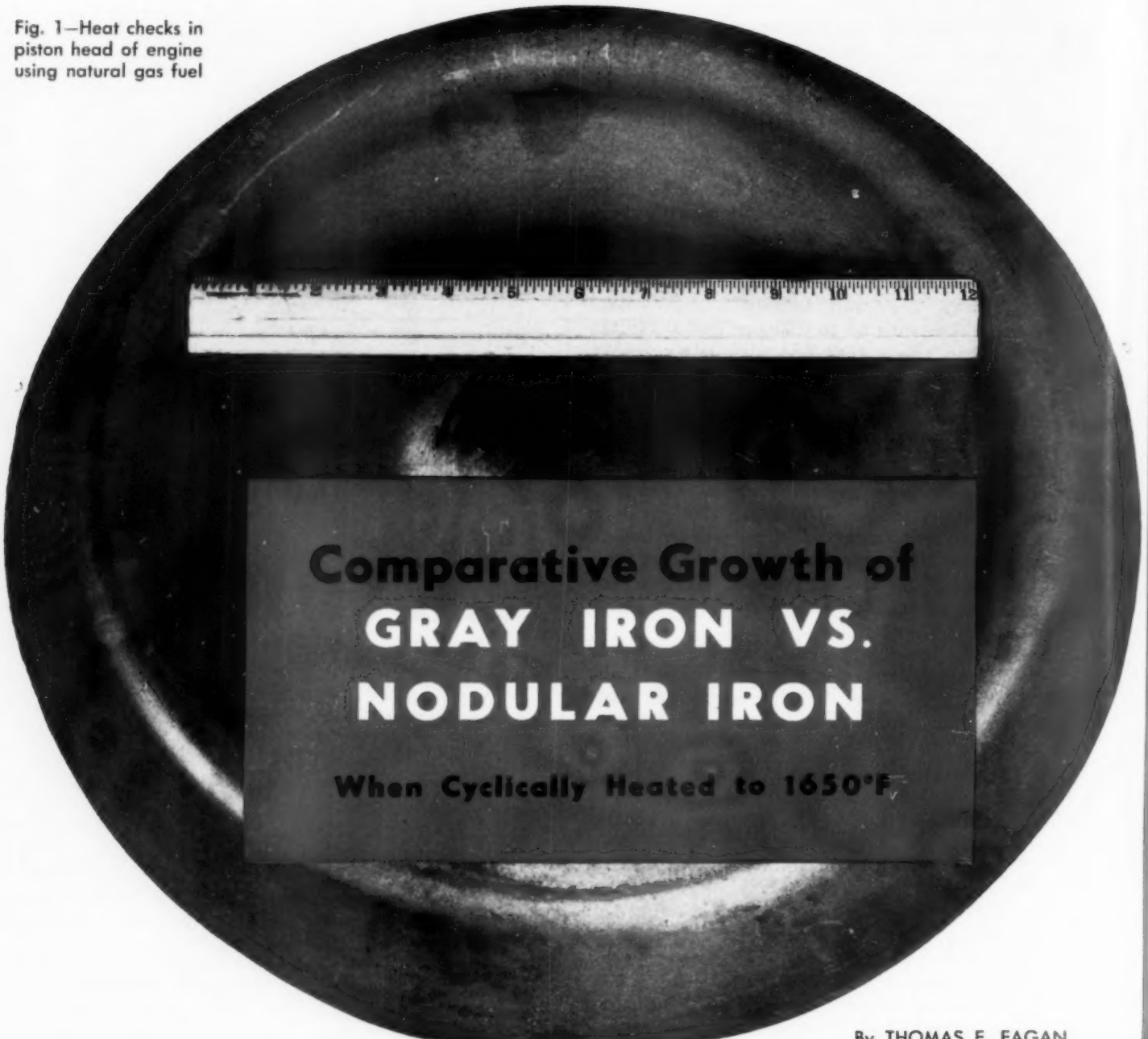

Fig. 1—Heat checks in piston head of engine using natural gas fuel

Comparative Growth of GRAY IRON VS. NODULAR IRON When Cyclically Heated to 1650°F

By THOMAS E. EAGAN
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IT IS a well known fact that unalloyed gray iron when heated to any temperature above a red heat changes in volume. This is a permanent change and is called growth. The amount of growth experienced depends on the temperature of heating, the time at temperature, the initial microstructure and the chemical analysis. The most drastic growth is experienced when the iron is repeatedly heated into the austenitic range and cooled. Alloying with elements which stabilize the combined carbon, such as chromium and vanadium, mitigate growth. Other alloys such as nickel in sufficient amounts to keep the matrix in the austenitic condition will also help. An exceptionally high carbon equivalent will also be helpful, chiefly because the silicon will cause an original almost complete graphitization of the matrix.

Growth in many instances precludes using normal unalloyed gray iron at high temperatures. It is, however, being used successfully when it is subjected to extremely high surface temperatures for brief periods of time, such as in brake drums and engine pistons. When failure does occur, the usual well known heat-checked pattern is shown.

In their first report on the physical properties of nodular iron Gagnebin, Millis and Pilling[1] call attention to the fact that this type of material has excellent resistance to growth. They attribute this to the fact that the graphite flakes offer easy paths to penetration by oxidizing gases, whereas the nodular type of graphite does not offer this convenience. It is the opinion of many that growth will take place even in the absence of oxidizing gases because of the graphitization of the combined carbon in the matrix. However, the presence of oxidizing agents would cer-

TABLE I—Growth at 1650° F for Various Holding Periods

Specimen No.	1 Hour		2 Hours		4 Hours		8 Hours		16 Hours		36 Hours	
	Total growth in 8"	Growth in 1"	Total growth in 8"	Growth in 1"	Total growth in 8"	Growth in 1"	Total growth in 8"	Growth in 1"	Total growth in 8"	Growth in 1"	Total growth in 8"	Growth in 1"
1	.053	.0066	.097	.0121	.137	.0171	.198	.025	.364	.083	.581	.073
2	.043	.0054	.055	.0069	.075	.0094	.107	.0134	.199	.025	.420	.052
3	.018	.0023	.024	.003	.035	.0044	.050	.0063	.092	.0012	.174	.022
4	.009	.0011	.013	.0016	.017	.0021	.025	.0031	.036	.0045	.056	.007
5	.014	.0018	.020	.0025	.024	.003	.027	.0034	.039	.0049	.039	.0049
6	.014	.0018	.024	.0031	.030	.0038	.031	.0039	.032	.004	.033	.0041
7	.014	.0018	.015	.0019	.015	.0019	.016	.002	.016	.002	.019	.0024

tainly increase the amount of growth, due to the formation of oxidation products in the space formerly occupied by the graphite flakes.

The piston heads of engines running on natural gas are subjected to extremely high surface temperatures. This presents a serious design problem in removing the heat developed. This heat removal is one of the limiting factors in the amount of power that can be developed in this type of engine. Oil cooling of the head is the method used to allow more power with greater efficiency. This requires that the section thickness of the head be reduced to the minimum allowable for the stresses applied.

Failure sometimes occurs after many hours of operation which can be attributed to heat checking caused by the incipient heating of the surface. Fig. 1 shows the heat checks in such a piston after many hours of operations. Nodular iron, because of its higher strength, would allow somewhat thinner sections in the head, thus allowing more efficient cooling. Furthermore, if good resistance to growth and heat checking is present, it would be a good type of material to use for this purpose.

The growth tests made by Gagnebin, Millis and Pilling consisted of heating to 1600°F, holding 1½ hours and air cooling for 100 times. They used a gray iron of 3.5 per cent total carbon and 2.5 per cent silicon; a 3.60 per cent total carbon, 1.9 per cent silicon with 0.9 per cent nickel and 1.3 per cent chromium; and a nodular iron of 3.5 per cent total carbon, 2.5 per cent silicon, and 1.8 per cent nickel. The results showed 12.1 per cent growth for the gray iron, 2.8 per cent growth for the alloyed gray iron and 2.1 per cent growth for the nodular iron. They obtained an oxide penetration of 0.5-in. or complete penetration for the gray iron, since the original specimen was 1 in. diameter. The chromium-containing iron had 0.063-in. depth of penetration and the ductile iron 0.026 in.

In view of the indicated superiority of nodular iron in an oxidizing atmosphere it was believed necessary to run a similar test in which the specimens were protected from the atmosphere using various grades of gray iron and nodular iron both in the as-cast and annealed condition. Such tests would at least indicate whether the growth was entirely due to oxygen penetration, to graphitization or perhaps a combination of both.

In consequence, specimens 8 in. long and ¾-in. diameter were machined from the seven grades of iron listed in Table II. Four of these grades were gray iron of the various ASTM-A48 classes listed which we believed gave a range of compositions which

TABLE II—Chemical Analysis of Material Used

	Si	Mn	P	Su	TC	Ni	Cr	Cu	Mo	Mg
1. Class 25 Gray Iron	2.27	.68	.20	.15	3.27	...	...	...	...	...
2. Class 35 plus alloy gray iron	2.10	.93	.16	.092	3.19	...	...	1.12	.37	...
3. Class 40 gray iron	1.28	.90	.093	.10	3.15	...	...	...	...	...
4. Class 40 plus alloy gray iron	1.55	1.01	.078	.069	3.06	.98	.341	...	.24	...
5. Nodular iron[2] as-cast	2.19	.47	.13	.009	3.43	1.95	...	...	...	.077
6. Nodular iron heat treated[1]	2.56	.54	.12	.010	3.50	1.50	...	...	...	.055
7. Nodular iron heat treated[2]	2.19	.47	.13	.009	3.43	1.95	...	...	...	.077

1—Cut from an experimental piston after heat treating.
2—Cut from 4.5-in.-wide keel block casting.

would be interesting. The three specimens of nodular iron were chosen deliberately. One specimen in the as-cast and one in the annealed condition were from the same metal. The other specimen was cut from an experimental gas engine piston annealed in a commercial manner.

After accurately measuring the length, the specimens were packed in a special container in fresh,

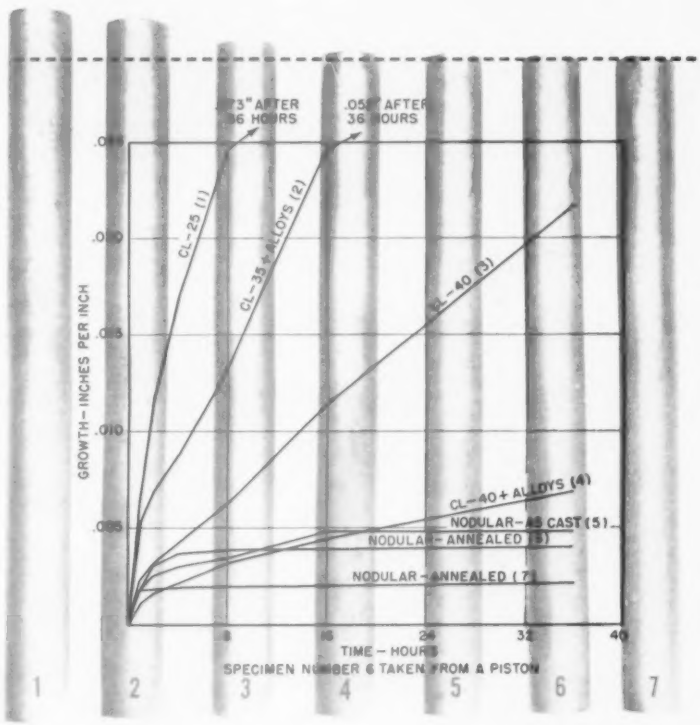


Fig. 2—Chart, showing growth of various iron specimens held at 1650°F, superimposed on Fig. 3 illustrating lengths of bars after 36 hours

TABLE III—Properties Before and After Treatment

No.	Material	Heat Treat	Original Physical Properties				After 36 Hr at 1650° F			
			Tensile	Yield	Elong	Bhn	Tensile	Yield	Elong	Bhn
1.	Cast iron Cl-25	as-cast	30,600	.....	....	193	5,800	retest	....	**
2.	Cast iron Cl-35 & Cu Mo.	as-cast	45,500	.....	....	269	13,250	.....	....	111
3.	Cast iron Cl-40	as-cast	52,600	.....	....	255	27,100	.....	....	143
4.	Cast iron Cl-40 & Ni Cu Mo	as-cast	53,100	.....	....	255	45,100	.....	....	187
5.	Nodular iron	as-cast	79,500	.....	....	285	81,100	62,800	2.5%	197
*6.	Nodular iron	annealed	65,600	53,000	7.0%	166	69,800	69,600	0.0%	187
7.	Nodular iron	annealed	71,000	57,300	7.5%	179	78,100	64,600	2.5%	187

* Taken from the skirt of a GMW-4A piston.
** Crumbled under the brinell test.

dry gray iron chips and then sealed with fire clay. A thermocouple was placed in a special tube that extended into the container. They were then heated to 1650°F in an electric furnace to hold for one hour after the container thermocouple indicated that they had reached temperature; then they were furnace cooled and measured. The same procedure was followed with holding times of 2, 4, 8, and 22 hours, making a total of 36 hours at temperature. The test was stopped at this point because the nodular irons failed to show much increase in growth.

Results are shown in Table I and in Fig. 2. The growth can be also seen in Fig. 3. It will be noted that the Class 25 gray iron grew at a rapid rate; after 36 hours at temperature it had grown 0.073-in. per in. or a total of 0.581-in. in 8 in. The Class 35 plus copper and molybdenum had a very high growth rate—0.052-in. per in.—showing the influence of graphitizing type alloys on growth. The comparison of Class 40 with a growth of 0.022-in. per in. and the Class 40 plus nickel, chromium and molybdenum, with a growth of 0.007 in. per in., is interesting. The addition of a small amount of chromium has cut the growth rate 66 per cent.

Growth rate of the various nodular iron specimens is entirely different than that obtained with gray iron. Most of the growth occurs during the first few hours, after which the growth rate is negligible. Total growth is very small compared with gray iron.

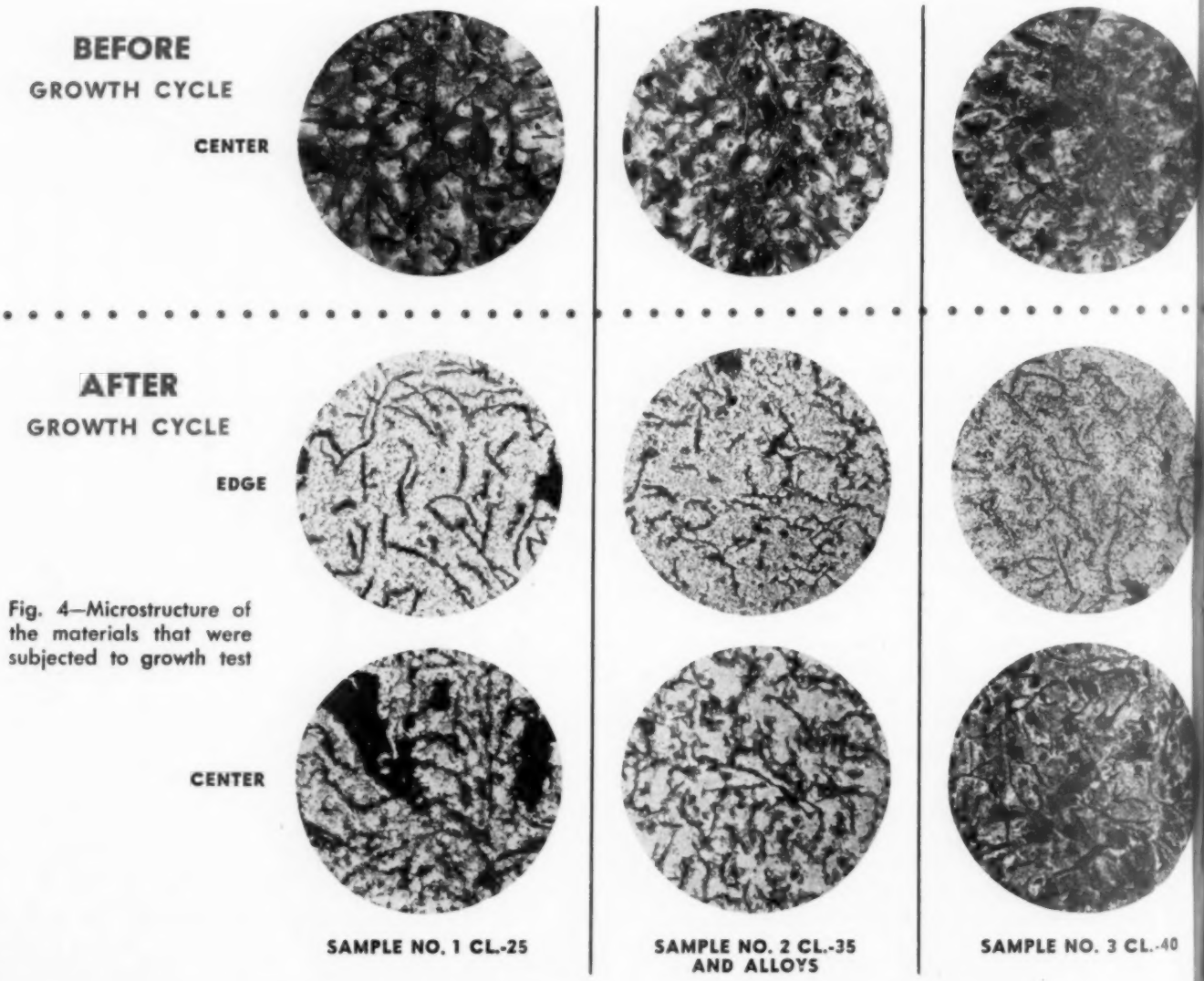


Fig. 4—Microstructure of the materials that were subjected to growth test

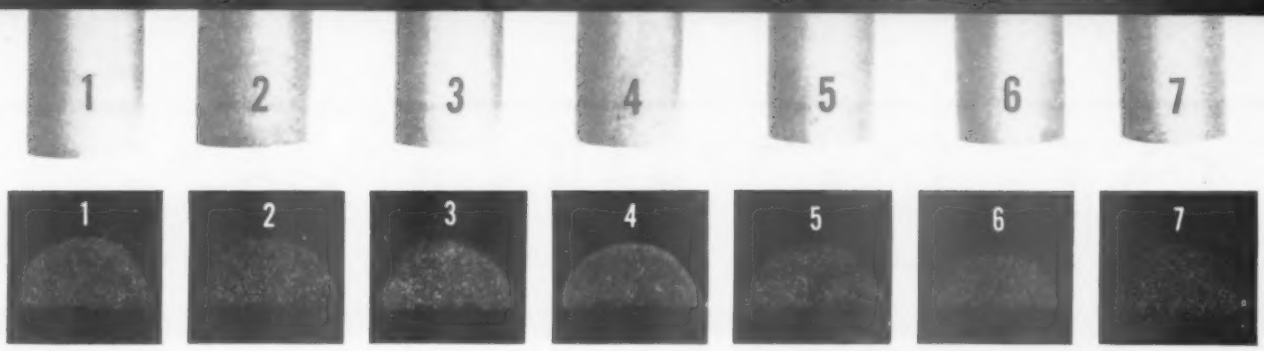


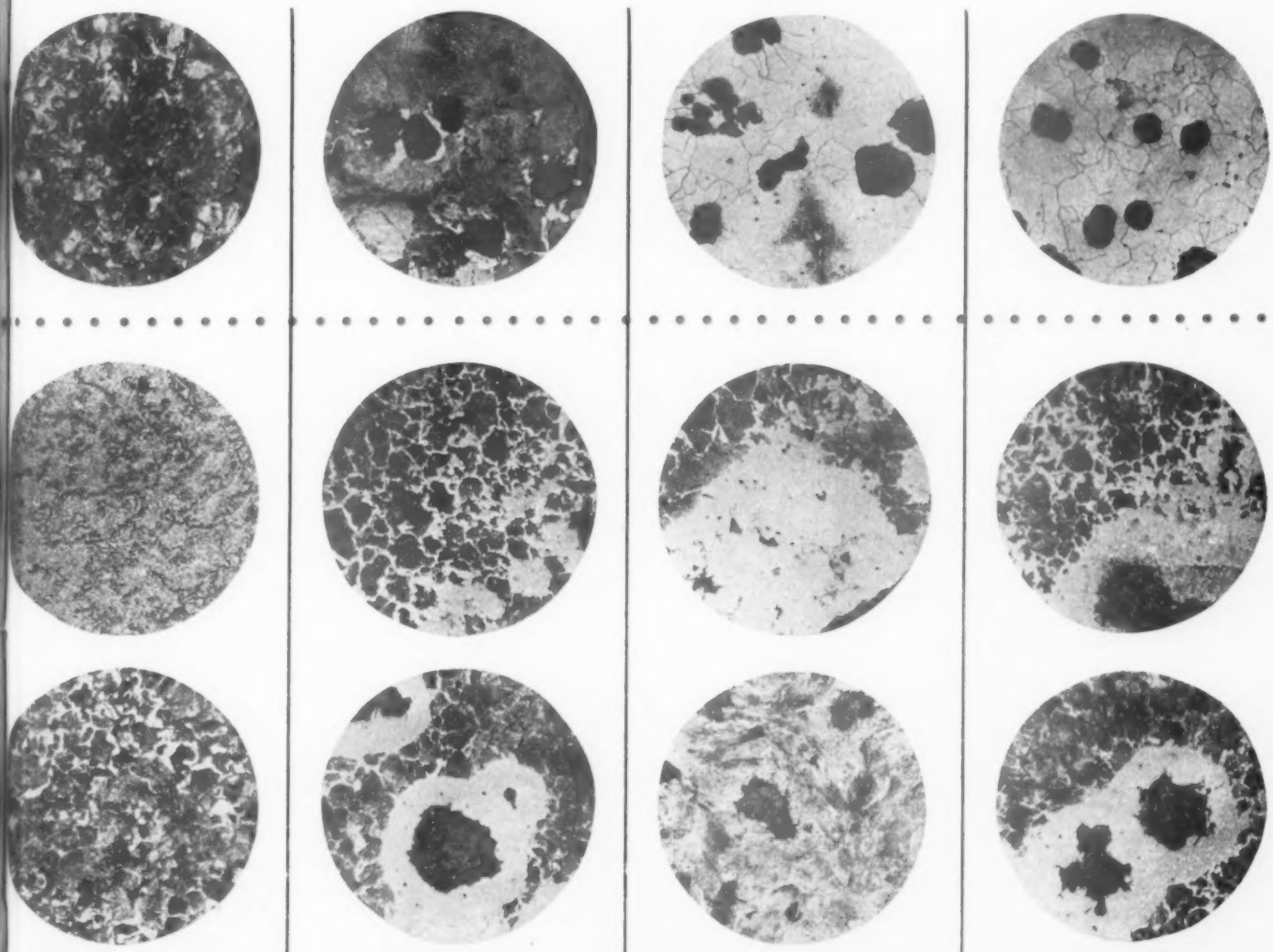
Fig. 5—Rim of oxidized metal was found on all specimens after tests. Specimens ¾-in. diam

Effect of annealing is well illustrated in specimens No. 5 and No. 7 which were from the same metal. No. 5 was in the as-cast condition and showed a total growth of 0.0049-in. per in., while No. 7, which was in the annealed state, showed a growth of 0.0024-in. per in. or one-half that of the as-cast material. In the case of specimen 6, which was taken from an annealed piston, the growth is 0.0041-in. per in., or about the same as the as-cast material.

To show the influence of this type of treatment on physical properties, tensile tests and brinell hardness were taken before and after the treatment and are shown in Table III. It will be noted that the Class 25 iron has almost completely disintegrated. The Class 35 iron plus nickel and molybdenum has also lost most of its strength, as has the Class 40 material. The addition of nickel, chromium and molybdenum seems to be beneficial as the cyclic treatment has caused a small loss in tensile strength.

All of the nodular irons show a distinct increase in tensile strength and yield point with a drop in elongation. In fact, most of the original elongation has been lost.

The loss in physical properties can be rather well explained by the change in microstructure. Fig. 4 shows the microstructure before and after the heat treatment. In preparing the sections for microexamination it was noted that there was a ring on the outside diameter of the specimens which varied in depth as shown in Fig. 5; hence two photomicrographs, one at the edge (*Please turn to page* 203)



SAMPLE NO. 4 CL.-40 AND ALLOYS

SAMPLE NO. 5 NODULAR—AS CAST

SAMPLE NO. 6 NODULAR—ANNEALED

SAMPLE NO. 7 NODULAR—ANNEALED

QUESTIONS and A

Sand Burns on to Gear Teeth

Q.—On our gear wheels up to 12 in. diam the sand burns onto the teeth. We shall appreciate any information on how to prevent this condition, the proper kind of sand to use and the best molding practice and equipment for quantity production.

A.—Facing sand containing 1 part coal dust to 8 parts sand will peel clean from the gear teeth. A medium coarse-grade sand is necessary for the purpose. Fine-grade sand will cause trouble in two ways. If it is rammed hard it will buckle and scab. If it is not rammed hard enough the teeth on the casting will be swelled out of shape.

The best method of ramming the sand into the teeth of a gear wheel pattern is to throw the sand into them by hand. Lay the pattern on the board or plate. Take a handful of the facing sand at a time and keep throwing it until all the teeth on the pattern are filled. The drag flask then is adjusted in place, filled with backing sand and rammed in the usual manner either by hand or on a molding machine. Any molding machine manufacturer whose name and address appears regularly in the advertising pages of THE FOUNDRY will be glad to supply details of equipment, operation and output capacity.

Water Vapor Causes Trouble

Q.—We are sending you two pieces of a 12½-in. diam gray iron gear which you will note is full of small holes. Can you tell us what is wrong with the iron? We never had this trouble before the furnace was lined three weeks ago. The casting was poured on the fourth tap—tapping 2000 lb on the tap. Some parts of the casting are solid.

A.—Fractured sections of the casting submitted for inspection are permeated with small holes which usually are termed pinholes in the foundry. The holes are somewhat elongated in shape, have bright shiny interiors, and mainly are located just under the skin or surface. To us that is an indication of metal which has been gassed sometime in the molten state. Generally such gassing is caused by water vapor (hydrogen) which is held in solution during the molten state, and ejected as the metal solidifies. However, due to formation of a solid skin at the mold-metal interface, the gas cannot escape to the exterior, and is concentrated just under that skin.

Possible sources of gassing are damp or green cupola lining, sand bottom or spout of the cupola, as well as a similar condition in the ladle. It hardly seems possible that the new lining after three weeks would cause the trouble, but with short heats, it may not be dried out. Perhaps the sand used in the bottom was too wet, and the molten iron tended to boil. Likewise, the spout on the cupola might not have been dried as well as it should. The same applies to the ladle. It is surprising how much heat is required to insure that a ladle is thoroughly dry. Instances have been described in steel casting where ladles dried at temperatures over 2000°F for several hours still showed the presence of water vapor which was absorbed by the steel.

Bronze Tablet Composition

Q.—We shall appreciate your advice on a suitable metal composition for bronze tablets. Also any hints or directions on the molding procedure.

A.—Various metal mixtures are employed for casting bronze tablets. One of the most popular mixtures is made up as follows: Copper 90 per cent, zinc 7.5 per cent, tin 2.5 per cent. Another mixture that runs well and has a good color consists of 89.5 per cent copper, 5 per cent tin, 5 per cent zinc and 0.5 per cent lead. The copper should be melted under a cover of dry granular charcoal with a little salt and borax. When in a fluid condition the white metals are added, and the mixture is stirred thoroughly. The metal must be hot and fluid to run large, thin castings.

More than ordinary skill is required for the production of ornamental bronze castings. Special molding methods must be applied if the tablet has undercut figures. Usually the figures have normal draft which simplifies the molding problem. Location of the gates must be given careful consideration, especially on large tablets. Good judgment also is required to estimate correctly the number of pouring sprues to produce a sharp casting free from strains. Mold and metal share equally the responsibility for a successful result. If the mold is not made properly the casting will be unsatisfactory regardless of the quality of the metal. If the metal is not right the most skilful molding will not save the situation.

A very annoying difficulty arises in ramming tablets, name plates and other flat castings containing letters or figures raised above a background. In the foundry this is known as "ramming-away." It may be defined as spreading of the mold face after the facing sand has been tucked. It may be partial, or may affect the whole face. The only satisfactory remedy is to shake out the mold and do the work over again. Ramming away is caused by a sliding

Answers

of the sand next to the face of the pattern. The sand moves away 1/16 to ⅛-in. on one side and crushes up against the opposite side. When the pattern is drawn the letter impressions may be twice as thick as they should be.

Weight Variations Are Small

Q.—As a student in engineering and interested in foundry practice and procedure, the question, "How close can a molder control the weight of a casting?" was brought up in a discussion. Castings referred to weigh 300 to 350 lb and are made of cast iron from metal patterns in steel flasks. Within what limits can the molder be expected to hold a 300-lb casting, assuming that pattern, flasks and sand are kept in a uniform condition? Are any figures available on the foundry weight variations on motor blocks in the automotive industry? If so, what would be the minimum and maximum weight allowed a molder on a 350-lb block?

A.—A molder has little or no control of casting weight when equipment and sand are kept in uniform condition, and standard practices are used in ramming. Machine molding permits standard ramming, and consequent uniform mold hardness. Where hand ramming is employed, it is possible to ram too soft which may permit swells and resultant overweight. Also when the molder is allowed to use his own gating and risering systems, weight variations may occur due to variations in metal pressure, density of casting, etc. Principal variable not mentioned in your query is pouring temperature. If that is held closely by the pouring crew, its effect on weight variation is minimized. As far as weight variations in motor block castings are concerned, we understand that it is a matter of ounces, if anything. Close control of all phases of production such as molding, coremaking, melting, etc., are such that variations are held to a minimum.

Cast-in Inserts Become Loose

Q.—We would like to cast ⅝-in. tool-steel inserts in some steel castings ⅝-in. thick. These inserts are ⅝-in. square and inasmuch as in time they will wear out, it is necessary that they can be pressed out of the castings by a hydraulic press. We will appreciate your advice on what material or materials can be used to coat the inserts in order to retard fusion, and thereby facilitate the pressing out process.

A.—It appears to us that your idea of casting-in the tool-steel inserts in steel castings will not give you the results anticipated in that the inserts will not be held tightly in position after the casting has cooled. When the molten steel comes in contact with the inserts the latter will expand to some extent, if only slightly, and the steel will then freeze or solidify around the enlarged inserts. When the two pieces cool, the amount of contraction will not be the same, so the insert will not be held tightly in position.

If a coating is necessary to prevent fusion, that in itself will make a loose fit. However, we believe that the inserts will not fuse unless they are in a location where considerable molten metal will flow over or around them. As far as a coating is concerned, we believe that the same silica material used as a mold and core wash will suffice, or any of the numerous proprietary materials available for that purpose or coating chills.

If you wish to obtain a tight fit of the inserts in the steel casting, it will be advisable to core out the holes slightly smaller than the ⅝-in. square inserts, and broach them to press-fit size. With suitable press or punch equipment, it would be possible to punch the holes from the solid.

Producing Hard Sand Matches

Q.—We are interested in acquiring a good formula for hard sand matches, particularly one using litharge and linseed oil as the binding agents. We would like to make up matches which will hold up for normal production runs.

A.—It is our opinion that you will be much farther ahead to purchase a proprietary material for making your hard sand matches rather than to try to make a suitable material. The proprietary materials, known as pattern compound, will give consistent

GANGWAY! By J. A. PATTERSON

"—And I claim somebody pushed me!!"

results when used according to the manufacturers' directions—which cannot always be said for the home-made mixes. The latter offer too much temptation to experiment, or opportunities for carelessness in compounding. There probably are as many different formulas as foundrymen that use them, but the two following are claimed to provide suitable results:

One is composed of one-half dry burnt sand and one-half dry new molding sand. The dry base-sand is mixed with litharge in the ratio of 1 part litharge to 40 parts sand. Then sufficient linseed oil is added to provide a consistency similar to a workable molding sand. The other mixture uses dry new molding sand to which is added linseed oil containing litharge to give it the consistency of well tempered molding sand. The oil-litharge solution is composed of 8 parts by weight of boiled linseed oil and 1 part litharge. With both compositions, after the match is made, it is set in a warm dry place for 24 hours, and then given a coat of shellac.

Small Adjustment Required

Q.—We have a considerable amount of cast iron scrap with machine steel fastened to it. Would 10 per cent of this material added to the cupola charge have any ill effect on our castings? Our usual mixture is one-third pig iron and two-thirds cast iron scrap. We make machinery castings.

A.—At one time the belief was quite prevalent that the addition of steel or wrought iron to the ordinary pig iron and scrap charge in a cupola would ruin any castings that had to be machined. At present the use of steel as part of the cupola charge is quite common and almost universal practice. It does not matter whether it is added in the shape you mention, or as a separate part of the charge as boiler punchings, steel rails, clippings or almost any other form of steel scrap. Silicon content of steel scrap is practically negligible and cast iron loses about 0.25 per cent silicon in the melting process. Therefore, in making up the charge it is necessary to allow for the absence of silicon in the steel and the cupola loss in the iron.

Your present mixture, one-third pig iron and two-thirds cast iron scrap, probably yields iron about as hard as you care to machine, especially in thin sections. Substitution of steel for part of the scrap charge will make the resulting iron still harder. You will have to use either a little more pig iron of the present grade, the same amount of pig iron with a higher silicon content, add about 5 lb of silicon in any of the various forms available to the present mixture or make ladle additions of any of the numerous graphitizing agents. Castings with blow holes and hard spots sometimes are attributed by amateurs to steel in the charge. Actually they are the result of poor molding or melting practice. For clean, solid castings the iron must be melted hot, particularly where steel is incorporated in the cupola charge. By hot is not merely meant hot enough to run, but what is known as smoking hot.

Hot Iron Dissolves Skimmers

Q.—We are seeking information relative to skimmers for alloy gray irons melted in an induction furnace. The iron skimmers we are using dissolve too readily in the molten bath, and we would like to know if there is a special type of graphite skimmer for such application, or if there is a type of refractory which can be applied to regular skimming irons which will give them longer life.

A.—It appears that the life of your iron skimmers could be extended by not using them as stirrers. There is no need for that since melting with high frequency electric current provides a continuous, gentle stirring action due to the electrical "pinch" effect. While there is no doubt that the iron is quite hot and will dissolve the skimmer to some extent, it should last a reasonable time if the skimming operation is performed quickly.

A graphite skimmer such as used for nonferrous work could be used, but if allowed to stay in contact with the molten bath for extended periods, we believe that some of the graphite will be dissolved, especially with extremely hot iron. That may or may not be of importance, depending upon whether or not you are trying to control the carbon content of the iron.

Solution of the iron skimmers in the bath can be held to a minimum by coating them with a silica or other refractory wash. The coating must be dried thoroughly or water vapor will be introduced.

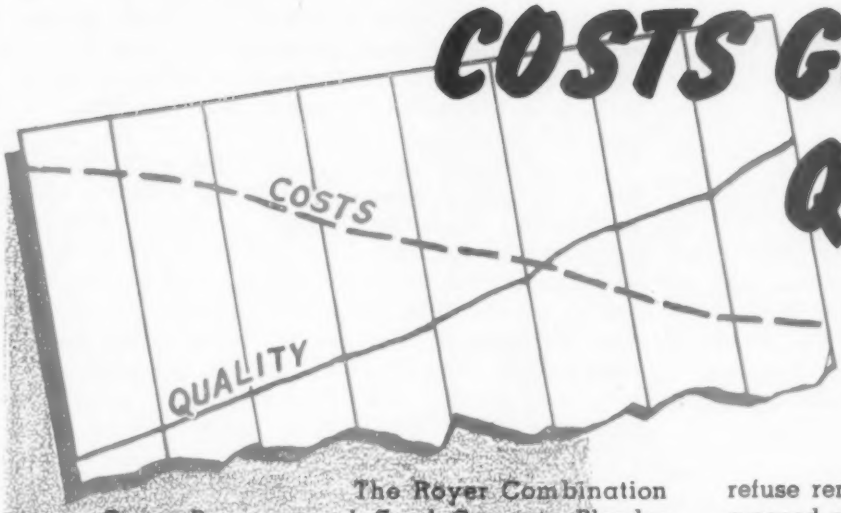
Steel Spokes Loose in Wheel

Q.—We are casting roller wheels weighing in the neighborhood of 4500 lb. Spokes connecting hub and rim are soft steel $\frac{5}{8}$ x $2\frac{1}{2}$ in. The rim is cast one day and the hub the following day. The wheel apparently is satisfactory when it leaves the cleaning room in the foundry, but when it has been machined and mounted on the roller, the spokes show a tendency to loosen and draw away from both hub and rim. We have had some discussion regarding the proper method of casting these wheels. There appears to be a difference of opinion as to whether the rim or the hub should be cast first. One member of our group, who is not a practical foundryman, claims that the hub and rim could be cast at the same time, preferably from the same ladle of metal.

A.—Universal experience indicates that where rim and hub of a wheel casting are separate castings, the rim must be poured first and allowed to cool to room temperature before iron is poured into the hub. Conceivably in a shop pouring metal continuously all day, the rim might be poured early in the morning and the hub late in the afternoon. However, 4500 lb wheels for road rolling machines usually are made in general jobbing foundries where all the metal is melted and poured in a comparatively short period in the afternoon. The interval between first iron and

(*Concluded on page* 104)

COSTS GO DOWN— QUALITY GOES UP



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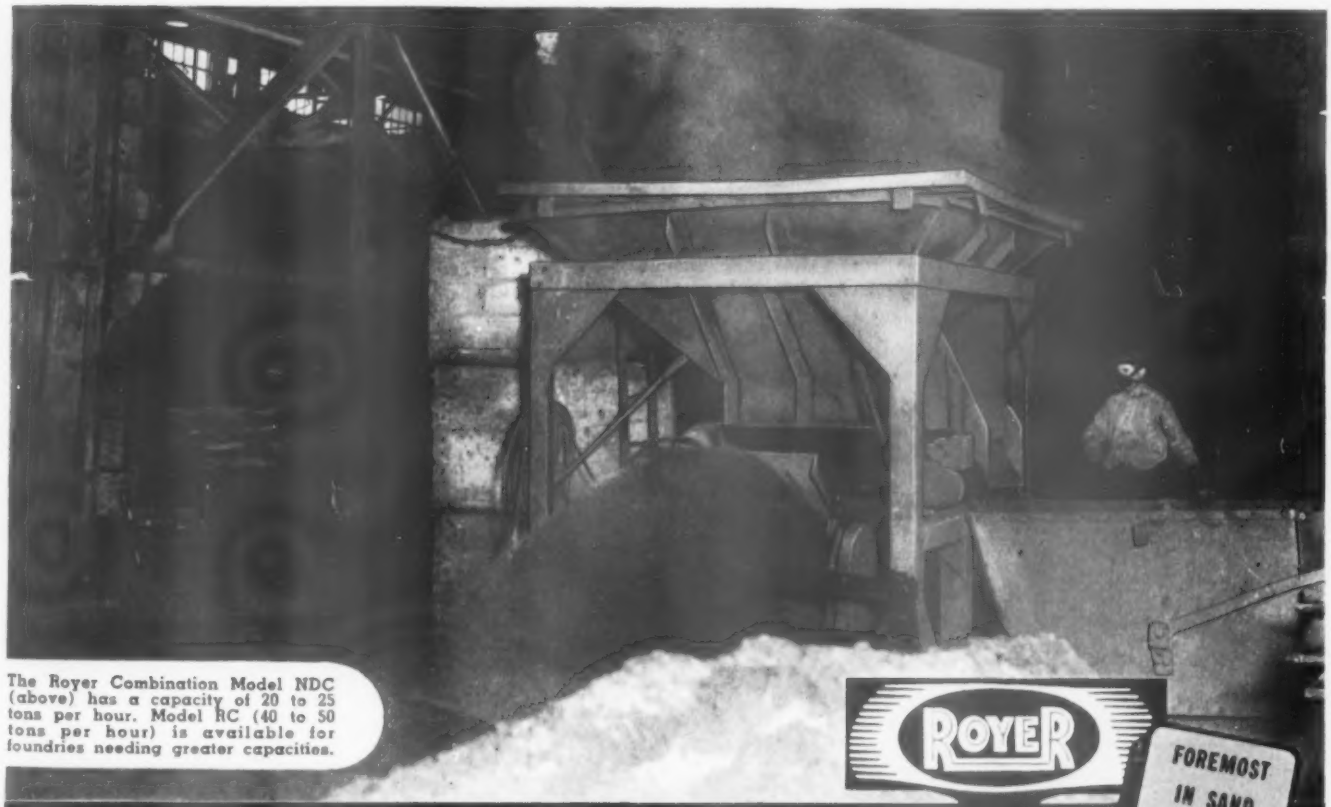

The Royer Combination Model NDC (above) has a capacity of 20 to 25 tons per hour. Model RC (40 to 50 tons per hour) is available for foundries needing greater capacities.

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ROYER FOUNDRY & MACHINE CO.

159 PRINGLE ST., KINGSTON, PA.

QUESTIONS and Answers

(*Concluded from page* 102)

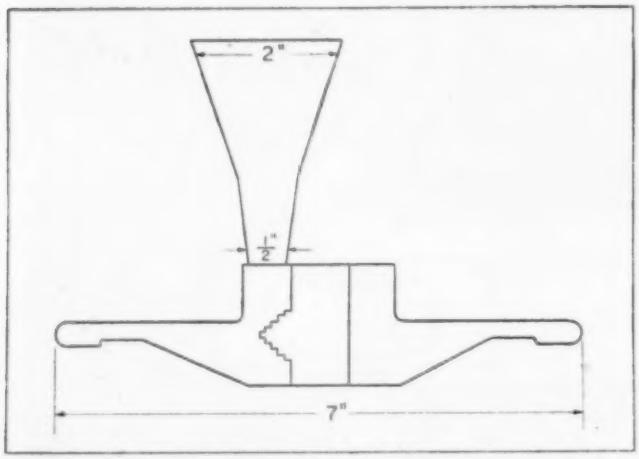
last iron is not sufficient to cool the rim to room temperature.

The logical and convenient process is to pour the rim one day and pour the hub the following day. On account of its greater circumference the rim contracts to a greater extent than the hub. The reason the spokes work loose usually is because the molten iron has not fused to them properly. There may be something on the ends of the spokes that repels the molten iron, or the iron may be poured at too low a temperature. To prepare the ends of the spokes they should be split or fork tailed and nicked with a chisel in the part to be surrounded with molten metal. The ends should be cleaned thoroughly to remove any rust or scale and either dipped in molten tin or painted with sodium silicate, commonly known as water glass. Hot iron should be poured into the mold. It is advisable to run about 50 lb of iron through the riser to carry off any gas bubbles.

Iron Sprocket Shrinks in Hub

Q.—We are forwarding for your attention a gray iron sprocket wheel 7 in. diam with a ¾-in. cored hole through the center hub. There is a large blow or shrink hole along side the center hole. This type of defect has persisted over a period of several years. We have tried strong cores, weak cores, vented cores, unvented cores. We have tried a heavy riser on the hub. We have added silicon to the metal in the ladle. We have poured the iron hot and we have poured the iron cold. All without result. Approximate analysis of our usual iron is: Silicon 2.2 to 2.50, sulphur 0.10 max., phosphorus 0.40 to 0.50, manganese 0.50 to 0.60, total carbon 3.25 to 3.50. We shall appreciate any suggestion on the solution of our problem.

A.—Analysis of your iron is satisfactory for the casting under discussion. The remedial measures you have employed include practically the entire available list. Failure of one and all would seem to justify you in the belief that the job is under a hoodoo. We would be in better position to offer an opinion if you had included several items that might have a bearing on the problem. For example: Style of gating, method of molding, hand or machine, number of patterns in a flask. Since the metal clearly is not at fault, it is reasonable to assume that the trouble is concealed in the mold.



Sprocket wheel casting is gated on top of the hub

The size, shape and position of the cavity in the hub confirms this opinion. It is a combination blow and shrink. With the castings covering almost the entire area of the flask all the generated steam must pass out between the lower edges of the drag and the bottom board. Where the bottom board is squeezed down tight the exit for gas and steam is reduced to some extent. This is not a factor of any importance in a mold where the steam can escape through the sides and ends of the mold or up through the joint. But it is an important factor in a mold where the bottom is covered by a tight board, where the sides and ends are enclosed in a tight flask or in a tight slip jacket, and where the castings occupy practically the entire area at the joint line. Some of the steam collects in the hub cavity and prevents proper feeding action when the heavy web starts drawing metal from the hub.

With the exception of instances where feed metal is induced to flow upward by atmospheric pressure, all feeding technique is based on the law of gravity. For that reason your practice could be improved by reversing the pattern and thus placing the hub in the drag. However, that is only a minor detail offered for adoption in the event you make new patterns. The lightening openings in the web might be enlarged, reamed out and tapered in the opposite direction. Coming from the general to the specific, you can prevent the blow-shrink in the hub by using a perforated bottom board, and by pouring each casting through a tapered sprue on top of the hub. This applies whether the job is molded two or four, or for that matter any number in a flask.

Cupola Lining Needs Supports

Q.—Our cupola is lined to 48 in. diam. Is it necessary to provide annular supports for the brick lining above the melting zone?

A.—An unsupported brick lining would give reasonable service for a considerable period where the heats are light and the bricks in the melting zone are burned only slightly every day. Where the heats are heavier and the bricks in the melting zone are burned back each day to a considerable extent, it is advisable to provide annular supports about 3 ft apart. The number will depend on the height of the charging door above the sand bottom. One ring above the charging door will support the brick lining from the door to the top of the stack. The rings above the melting zone prevent the lining from bearing on the weakened bricks in the melting zone partly burned away on account of the maximum temperature in this area.

Fire brick begins to soften and consequently is weaker at temperatures considerably below the fusing or melting point. In a typical instance a lining without supports lasted only 8 months. With three annular supports the lining lasted a year and a half.

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MEN of Industry

JOHN HELLSTROM, vice president, American Air Filter Co., Louisville, is manager of its recently created Pacific Division, which includes offices and representatives in California, Oregon, Washington, Idaho, Montana, Utah, Arizona, New Mexico and western Texas. With headquarters in San Francisco he will supervise business activities of both American Air Filter Co. and its Herman Nelson Division, Moline, Ill., in the Pacific territory, assisted by **Robert H. Walpole Jr.,** who has spent 4 years as engineering supervisor of the company's Dust and Fume Control Division in San Carlos, Calif. A pioneer in air filtration and dust control, Mr. Hellstrom was president of Midwest Air Filters Inc. until it merged with several other companies to form American Air Filter Co., when he became vice president in charge of the Dust and Fume Control Division. He was president of the Foundry Equipment Manufacturers' Association last year and has been one of its directors for 3 years.

♦ ♦ ♦

Don Smith recently was appointed general plant manager in charge of the Peerless and Superior Plants, Wellman Bronze & Aluminum Co., Cleveland. Mr. Smith, who served his apprenticeship at the Forth & Clyde Steel Works, Scotland, came to the United States in 1928 and worked as a molder for Aluminum Co. of America. In 1939 he became shift foreman at its Magnesium Division, Cleveland and in 1941 was transferred to Bridgeport, Conn., as general foundry foreman, later becoming assistant superintendent. He was appointed superintendent of the Peerless Plant of Wellman Bronze & Aluminum Co. in 1943 and plant manager the following year.

♦ ♦ ♦

Kenneth R. Proud, president of the Rochester Chapter of the AFS for the current year, is foundry manager and purchasing agent, the Anstice Co., Rochester, N. Y. Mr. Proud was born and educated in Oswego, N. Y. He joined the Anstice Co. in 1925 and served as cost clerk, payroll department head and personnel manager. Active in the Rochester Chapter, he has served as one of its directors and was vice president last year.

♦ ♦ ♦

E. J. Bomholt has been named plant manager of the New Idea Division, Avco Mfg. Corp., New York, succeeding **F. J. Seals,** who has resigned. Mr. Bomholt joined the repair department of the New Idea Division in 1923. He subsequently became director of purchases, production manager, and early this year became general superintendent. As plant manager he will be responsible for production at both the Coldwater, O., and Sandwich, Ill., factories.

♦ ♦ ♦

William E. Mulcahy has been appointed assistant foundry superintendent, Hunt-Spiller Mfg. Corp., Boston. Prior to an association, earlier this year, with Boston Electro Steel Casting Inc., Boston, Mr. Mulcahy served at Hunt-Spiller as castings inspector, assistant chipping room foreman, cleaning department foreman, and assistant works manager.

♦ ♦ ♦

Stanley M. Tracy, executive vice president, Driver-Harris Co., Harrison, N. J., recently completed 40 years of service with the company. Mr. Tracy joined the Harrison plant in 1910 as a cost clerk, later became treasurer, a director in 1922, and executive vice president in 1938. He is also a director of the European branches of the company located in England, Ireland, also in France and Italy.

♦ ♦ ♦

Lester B. Knight, president, Lester B. Knight & Associates Inc., consulting engineers, Chicago, has been elected chairman of the board of directors, Universal Castings Corp., Chicago. Mr. Knight, who has been managing director of the company since 1946, will continue in that capacity.

♦ ♦ ♦

Frederick F. Head has been named an administrative assistant, Malleable Founders' Society, Cleveland, to handle statistics, cost accounting studies and related activities. Mr. Head was graduated from Fenn College, and until recently was an accounting supervisor, Central Furnaces & Docks, American Steel & Wire Co., Cleveland. Previously he was asso-

(*Continued on page* 108)

JOHN HELLSTROM

DON SMITH

KENNETH R. PROUD

E. J. BOMHOLT

Careful Preparation Precise Timing Accurate Control

These have been major factors in the magnificent success of our army in Korea.

They are also major factors at Woodward in making pig iron.

Woodward Iron Company consistently maintains uniformity in quality of its merchant iron output by careful preparation of raw materials, precise timing of production schedules, accurate control of moisture in the air blast. Ask any foundryman who uses—

UNIFORM WOODWARD PIG IRON

WOODWARD IRON COMPANY

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GENERAL SALES OFFICE: 1515 First National Building • Birmingham, Alabama • Phone 54-1667

MEN of Industry

(*Continued from page* 106)

ciated with Basic Refractories, Cleveland, California Institute of Technology and War Assets Administration.

• • •

L. Guilmette, who has been named chairman of the Eastern Canada Chapter of the AFS for the year 1950-51, is secretary-treasurer, Canadian Foundry Supplies & Equipment Ltd., Montreal, Que. Mr. Guilmette has been associated with the company since 1925. He served as treasurer of the Eastern Canada Chapter for 4 years, and was vice chairman last year.

• • •

R. C. Nelsen was recently appointed Chicago district manager, Sterling Wheelbarrow Co., with headquarters at 308 West Washington St., Mercantile Exchange Bldg. Mr. Nelsen graduated from the public schools of Racine, Wis. and attended the University of Wisconsin. From 1936-1940 he was associated with Belle City Malleable Co., Racine, Wis., and from 1941-1944 was with the Wehr Steel Co., Milwaukee. He joined the Milwaukee office of Sterling Wheelbarrow Co. in 1945 and in 1949 was transferred to the Chicago office.

• • •

John W. Horner Jr., serving as chairman of the Timberline Chapter of the AFS, is vice president and manager, the Slack-Horner Brass Mfg. Co., Denver. Mr. Horner comes from a line of foundrymen, his great grandfather having been engaged in the manufacture of car wheels in New York City and his father is founder and president of the Slack-Horner Brass Mfg. Co. Born in Denver, John W. Horner Jr. attended the public schools there and spent a year at University of Colorado and two years at Colorado School of Mines. He worked part time as a foundry apprentice from 1933 to 1937, and then joined Slack-Horner. He became foundry foreman in 1942, foundry superintendent in 1944, and vice president-manager in 1948. Mr. Horner has written several articles on foundry subjects which have been published in The FOUNDRY and other technical magazines. He served as treasurer and secretary of the Timberline Chapter before becoming vice chairman last year.

• • •

Dr. Tracy C. Jarrett has been appointed representative for industrial heat treating equipment manufactured by C. I. Hayes Inc., Providence, R. I., to serve the area west of the Mississippi, to the Rockies, and south to Dallas, Tex., with headquarters in Denver. Dr. Jarrett spent 6 years as assistant chief metallurgist, American Optical Co., Southbridge, Mass., and for the last 9 years was associated with Koppers Co., Baltimore, where he was chief metallurgist and more recently manager of engineering and research for the piston ring department of its Metal Products Division.

• • •

B. S. Stephenson, president, Tonawanda Iron Division, American Radiator & Standard Sanitary Corp., Pittsburgh, has retired, following 24 years with the company. After graduation from Ohio State University Mr. Stephenson spent several years in newspaper work, and in 1905 became associated with THE FOUNDRY and *Iron Trade Review* (now *Steel*). Joining M. A. Hanna & Co., Cleveland, in 1910, he successively had charge of the Pittsburgh, Cincinnati and Detroit offices. Mr. Stephenson joined American Radiator, predecessor of American-Standard, in 1926 and served as vice president in charge of purchases. In 1938 he became president of Tonawanda Iron Corp., North Tonawanda, N. Y., which was made a division of American-Standard two years ago.

• • •

Walter C. Troy has been named assistant chairman of the metals research department, Armour Research Foundation, Illinois Institute of Technology, Chicago, in addition to his present duties as supervisor of heat treating and powder metallurgy research. Mr. Troy was graduated from University of Notre Dame and later attended Carnegie Institute of Technology. He spent 9 years with Westinghouse Electric Corp., Pittsburgh, prior to joining the foundation in 1947.

• • •

O. P. Robinson has been named manager of the Pittsburgh district sales office Cutler-Hammer Inc., Milwaukee, succeeding **T. S. Towle,** retired, who has spent the last 21 of his 36 years with the company in Pittsburgh. Mr. Robinson, a graduate of Armour Institute of Technology, joined the Chicago district sales office in 1936 and was transferred to the Pittsburgh sales office in 1940. He will also supervise sales of the company's electrical apparatus in the Youngstown office.

• • •

John S. Coey, since 1943, manager of sales development, Hooker Electrochemical Co., Niagara Falls, N. Y., has been named eastern sales manager. Mr. Coey, a graduate of Amherst College, joined the company in 1937. **Thomas H. Trimble,** formerly eastern sales supervisor, has been appointed assistant manager of the Niagara sales office. Mr. Trimble

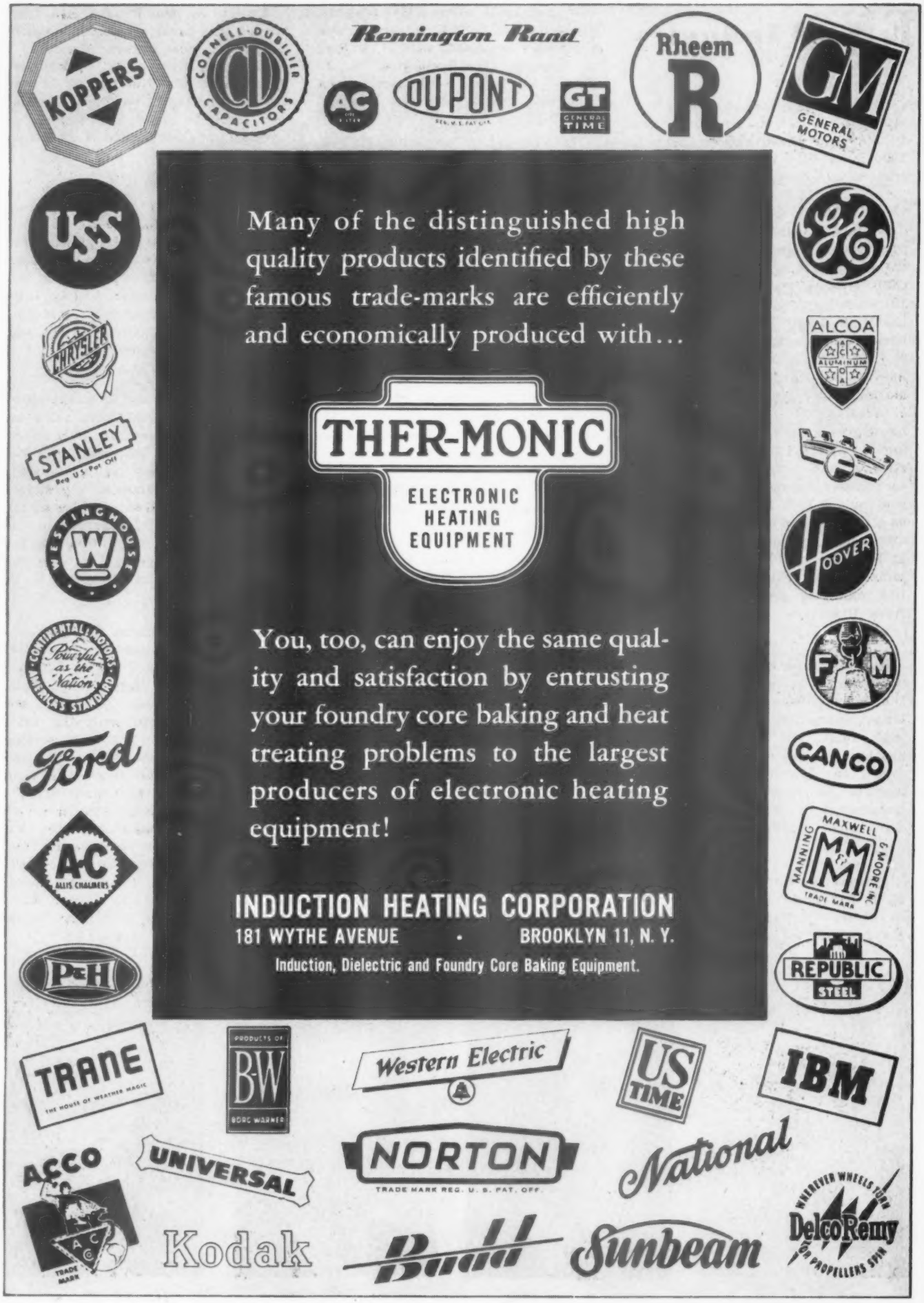
(*Continued on page* 110)

L. GUILMETTE

R. C. NELSEN

JOHN W. HORNER JR.

DR. TRACY C. JARRETT


Many of the distinguished high quality products identified by these famous trade-marks are efficiently and economically produced with...
THER-MONIC
ELECTRONIC HEATING EQUIPMENT
You, too, can enjoy the same quality and satisfaction by entrusting your foundry core baking and heat treating problems to the largest producers of electronic heating equipment!
INDUCTION HEATING CORPORATION
181 WYTHE AVENUE • BROOKLYN 11, N. Y.
Induction, Dielectric and Foundry Core Baking Equipment.
KOPPERS
CORNELL-DUBILIER CAPACITORS
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DU PONT
GENERAL TIME
Rheem
GM
GENERAL MOTORS
USS
CHRYSLER
STANLEY
WESTINGHOUSE
CONTINENTAL MOTORS
Ford
A-C
P&H
TRANE
B-W
Western Electric
US TIME
IBM
NORTON
UNIVERSAL
ACCO
Kodak
Buda
Sunbeam
National
DelcoRemy
ALCOA
HOOVER
CANCO
MAXWELL
REPUBLIC STEEL

MEN of Industry

(*Continued from page* 108)
was graduated from Princeton University, and joined the company in 1934 as a field salesman, becoming eastern sales supervisor last year.

♦ ♦ ♦

William K. Gibb has been appointed inspector of castings, Boston Electro Steel Casting Inc., Boston. Mr. Gibb entered the foundry industry 10 years ago as an apprentice at the U. S. Navy Yard, Puget Sound, Bremerton, Wash., where he remained 6 years and became a journeyman molder. Following a year in the U. S. Marine Corps he entered University of Washington. While studying for his degree in metallurgical engineering he was a part-time foundry instructor and taught evening classes to foundry apprentices. During the summers of 1948 and 1949 he worked as a molder at Western Steel Casting Co., and as an analytical metallurgist at N. & S. Foundry Co., Seattle. He joined Boston Electro Steel Casting Inc. following graduation last June from University of Washington.

♦ ♦ ♦

Robert G. Van Keuren has been appointed chief sales engineer, Abrasive Division, Norton Co., Worcester, Mass., succeeding the late A. Oakleigh Bush. Mr. Van Keuren, who has been a sales engineer since 1945, joined the Worcester sales department of the company in 1923 and was transferred to the sales engineering department in 1929.

♦ ♦ ♦

Charles W. Lueders Jr., Riverton, N. J., has been named representative in eastern Pennsylvania for Carl-Mayer Corp., Cleveland, builder of core and mold ovens. Mr. Lueders, a graduate of Lehigh University, was previously associated with U. S. Pipe & Foundry Co., Burlington, N. J., Dodge Steel Co., Philadelphia, and American Steel Foundries, Granite City, Ill.

♦ ♦ ♦

Charles T. Jorgensen, president, has announced the formation of the U. S. Engineering Corp., with offices at 316 East Silver Spring Drive, Milwaukee, for the design, manufacture and erection of conveyor and material handling systems. Mr. Jorgensen, for the last 7 years Milwaukee district sales manager, Palmer-Bee Co., Detroit, has spent 25 years in the conveyor industry. **J. H. Fletcher,** vice president, and **L. F. Miller,** vice president-treasurer, of the new company, will be in charge of a district sales office at 19350 Littlefield St., Detroit 35. They have been associated with Palmer-Bee Co., in administrative capacities, for over 20 years. R. H. Oberndorfer, Milwaukee, is secretary and legal counsel.

♦ ♦ ♦

Raymond L. Collier has resigned as executive vice president of the Gray Iron Founders' Society, Cleveland, following four years in that position. Previously for 18 years he was with the Steel Founders' Society of America. Mr. Collier plans to reenter the trade association field, with which he has been identified for more than 25 years. **Donald H. Workman** has been appointed by the Gray Iron Founders' Society to serve as acting executive vice president.

♦ ♦ ♦

J. R. Mohlie has been appointed director of defense operations, Oliver Corp., Chicago, manufacturer of farm and industrial equipment. Mr. Mohlie will be in charge of planning and scheduling production of defense material at the midwestern plants.

Ernest A. Hund, who has been named vice president of the recently organized Push-Button Foundry Equipment Division, W. G. Reichert Engineering Co., Newark, N. J., was erroneously reported in the November issue to have been appointed president of the division. W. G. Reichert is president.

♦ ♦ ♦

Fred E. Haker, director of purchases, Allis-Chalmers Mfg. Co., Milwaukee, has retired, following 50 years of service. Mr. Haker has been associated with the purchasing department of the company since 1916. **Kenneth Geist,** who has served as assistant to Mr. Haker, for the last two years, will succeed him.

♦ ♦ ♦

M. C. Larson has been appointed manager of the Baltimore sales office, Cutler-Hammer Inc., Milwaukee, succeeding **R. A. Haworth,** who has been named district sales manager, Dallas, Tex. Mr. Larson, a graduate of University of Minnesota, joined the company in 1929. He served in the Cleveland district sales office and for the last 2½ years has been in the Philadelphia district office.

♦ ♦ ♦

William F. Williams has been appointed vice president in charge of manganese sales, Taylor-Wharton Iron & Steel Co., High Bridge, N. J. A graduate of Yale University, Mr. Williams has been with the sales department since 1920. He became northeast sales manager in 1944 and director of manganese sales in June of this year. **H. E. Cragin Jr.** has been named assistant vice president in charge of manganese sales. Mr. Cragin joined the engineering and manufacturing department of the company in 1934, following graduation from Princeton University. After serving as foundry and plant super-

(*Concluded on page* 112)

WILLIAM K. GIBB

ROBERT G. VAN KEUREN

CHARLES W. LUEDERS JR.

CHARLES T. JORGENSEN

Constant . . . Development

The All-New GROOVESTEM brings your foundry

1. Assured Core Support
2. Maximum Fusion
3. Freedom from Leakers
4. Accurate Wall Thickness

Attention to Detail makes FANNER CHAPLETS AND CHILLS the Finest Procurable

Important Notice:

Two motion picture films—one on the use of Chaplets, the other on the use of Chills—are available, free of charge, for showing at Foreman Club meetings, in technical schools, A. F. A. chapter meetings, etc. Write for reservation.

THE FANNER MANUFACTURING CO.

BROOKSIDE PARK
CLEVELAND, OHIO

CANADIAN FANNER, LTD. HAMILTON, ONTARIO

Birdseye view of the Fanner Brookside Park plant in Cleveland

MEN of Industry

(*Concluded from page* 110)

intendent, he became assistant to the president in charge of engineering and research earlier this year. **John P. Reynolds,** who has been appointed assistant sales manager, has been with the company since 1941 and has served as timekeeper, industrial engineer and salesman, most recently in the sales department of the High Bridge plant.

• • •

W. H. Lyne, who is serving as chairman of the Texas Chapter of the AFS for 1950-51, is foundry planning engineer, Hughes Tool Co., Houston. Mr. Lyne was born in Houston and attended Rice Institute and University of Houston. He joined Hughes Tool Co. in 1936 and worked as chemist, melter and assistant foundry engineer. In 1942 he became foreman of the Dickson Gun Plant, operated by Hughes, and two years later was made process and research engineer at the tool company. He was foundry engineer from 1945 to 1948, when he became foundry planning engineer. Active in the Texas Chapter, Mr. Lyne served as its vice chairman last year.

• • •

Frank S. Brewster, for the last 4 years sales manager, Harry W. Dietert Co., Detroit, has been appointed general manager. Mr. Brewster was graduated from Michigan State College in 1926. Previous associations include metallurgist, Atlas Drop Forge Co., chief chemist, Saginaw Malleable Iron Division, GMC., chief metallurgist, Baker-Perkins Inc., Saginaw, Mich., and sand engineer, Dow Chemical Co., Magnesium Division, Midland, Mich.

Donald R. Smith has been appointed manager, special products division, Ironton Fire Brick Co., Ironton, O. Mr. Smith, who became associated with the company in 1941, joined the Navy two years later. Following release from service he attended Ohio State University, where he received his degree in ceramic engineering, specializing in development of special refractories for the foundry and steel industries.

• • •

Bertram V. Jones has been named advertising manager, Link-Belt Co., Chicago, succeeding the late Julius S. Holl. Mr. Jones, who joined the company's advertising department in 1923, became assistant advertising manager in 1949 and executive assistant advertising manager in July of this year. **John F. Kelly** continues as assistant advertising manager.

• • •

Mervin A. Fay, until recently ceramic engineer in the research department, General Refractories Co., Philadelphia, has been appointed assistant general sales manager. Mr. Fay was graduated from Pennsylvania State College in 1937, and was previously associated with Bethlehem Steel Co.

• • •

M. B. Garber has been named director of sales, the Thew Shovel Co., Lorain, O. **J. T. Cushing** has been appointed sales manager and **Robert Maynard** continues as export manager. **Q. J. Winsor,** formerly assistant general manager, has been made manager of development sales.

• • •

Robert D. Hill has been elected vice president, Taylor-Wharton Iron & Steel Co., High Bridge, N. J. in addition to his present duties as treasurer. A graduate of University of Pittsburgh, Mr. Hill was associated previously with Noma Electric Corp., New York, Union Switch & Signal Co., Swissvale, Pa., and served as a special agent with Federal Bureau of Investigation.

• • •

John A. Bukowski has been appointed general superintendent, Atlas Stainless Steel Foundry, Irvington, N. J. Mr. Bukowski has been associated for 17 years with Worthington Pump & Machinery Corp., Harrison, N. J., most recently as works metallurgist.

• • •

W. J. McSherry, until recently assistant sales manager, has been named sales manager, David Round & Son, Cleveland, succeeding **W. G. Holley,** who has become general manager. Mr. McSherry has been associated with the company for 12 years.

• • •

Austin C. Ross has been elected a vice president, Worthington Pump & Machinery Corp., Harrison, N. J. Mr. Ross, who joined the company in 1932, and became manager of the Buffalo works in 1940, will continue in that position.

• • •

Dr. Rudolph Zillman has joined Pittsburgh Steel Foundry Corp., Pittsburgh, as a metallurgist. Dr. Zillman received his doctor's degree in metallurgy at Massachusetts Institute of Technology.

• • •

Melvin O. Sten, chief engineer, Hunt-Spiller Mfg. Corp., Boston, recently completed 25 years of service. A graduate of Northeastern University, Mr. Sten joined the company in 1925 as a draftsman.

• • •

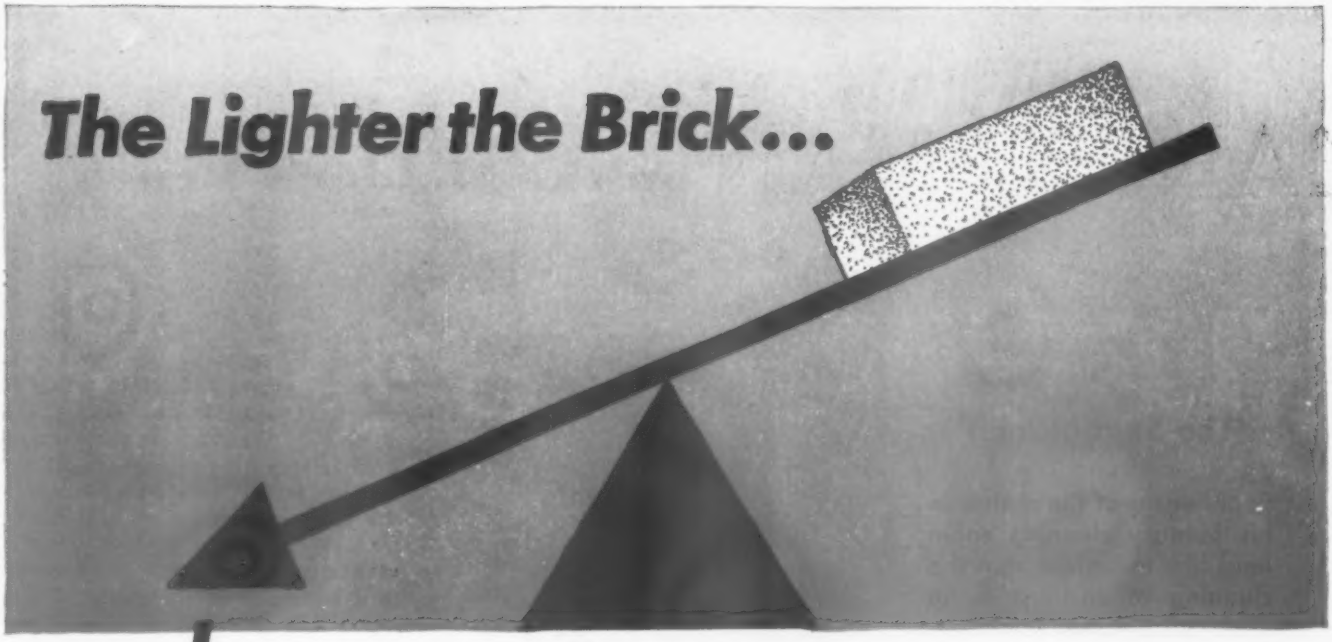
Lawrence W. Meyers, formerly cost accountant, West Michigan Steel Foundry Co., Muskegon, Mich., has joined Sansteel Metallurgical Corp., Chicago, in that capacity.

W. H. LYNE

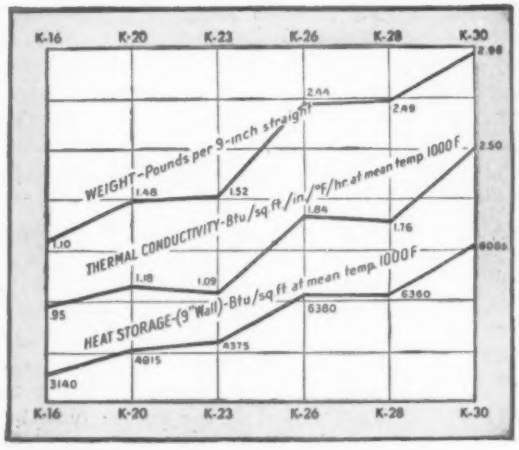
FRANK S. BREWSTER

DONALD R. SMITH

BERTRAM V. JONES



...the Lower the Heat Loss



The performance of an insulating firebrick is closely related to its weight. The graph illustrates this principle. It shows how you can profit by adopting the insulating firebrick having the lightest weight consistent with load and temperature requirements.

...And B&W IFB Are The Lightest In Their Class

Because B&W Insulating Firebrick store and conduct less heat than heavier insulating firebrick, they afford faster heating-up time. This means that less fuel is required to bring the furnace to operating temperature—with consequent savings in overall operating costs.

Today, thousands of industrial furnace operators are enjoying direct savings in production costs through the use of B&W Insulating Firebrick. If you want more detailed information on how these lightest of all insulating firebrick can benefit you, just call for your local B&W Refractories Engineer.

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B&W REFRACTORIES PRODUCTS

B&W 80 FIREBRICK • B&W JUNIOR FIREBRICK
B&W 80 GLASS TANK BLOCKS • B&W INSULATING FIREBRICK
B&W REFRACTORY CASTABLES, PLASTICS AND MORTARS

•

OTHER B&W PRODUCTS

Stationary & Marine Boilers and Component Equipment
Chemical Recovery Units... Seamless & Welded Tubes... Pulverizers
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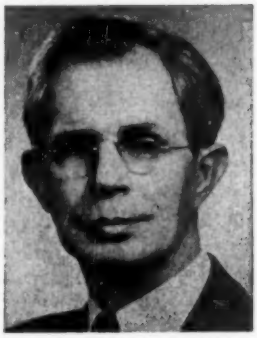
MAN·TO·MAN on the Molder's Bench

"The Snagologist"

Experiences of the author in his foundry cleaning room lead him to believe that the cleaning of castings is an underrated job



By RALPH L. LEE

SOME time ago, after swearing a bit while trying to use one of these cheap, blinkety-blank, tin horn pencil compasses in laying out a pattern, I decided to settle the matter once and for all. So I designed one myself and, believe me, the pencil on this one will not only stay put but can easily be slid up and down when you want to do it. You can also set the darned thing right on the nose for a circle that won't change in diameter while you are drawing it.

Some of my patternmaker friends saw this gimmick and drooled a bit, so that first thing I knew I was hard at the job of making a cope and drag pattern plate. I made this plate so that, with the exception of a few holes, there wouldn't be any machining and the smallest amount of grinding and cleaning possible. I even cast the little screws into the wing nuts as inserts and phonograph needles into the center legs.

One evening with quite a heap of castings still gated to the runners and sprues, I was having a real good time all by myself up there in the Lee Hobby Foundry sawing off the pieces. I went zipping down one side lickty-split, but when I came to the other side the damned sprue was in the road, particularly where the metal had slobbered over on top of the mold. I made a mental note that I was going to have to watch this pouring business from now on.

Then as I sawed away I wondered why the devil I hadn't allowed more room between the sprue and the places where the gates had to be cut. That set me to thinking how much I could cut down the gates, for I notice that some of the castings ran fine with much smaller gates than others.

On the drag side I had put some bumps on the runners that I thought ought to be there for feeding, but they made the casting teeter around when I tried to saw. I made another mental note to see what would happen if they were trimmed off. They could be put on again if I had to.

Fins on some of the castings reminded me that the pins of the flask must be loose. The fine shiny finish on some of the castings, the dull hot look on others and cold shuts on still others yanked me up short to the need for a much closer check on melting temperatures.

Then it dawned on me how lucky the Lee Hobby Foundry was in having its cleaning department headed up by a Jack-of-all-trades, who was a half-baked designer, a none too hot patternmaker, a just so-so molder, a barely passable melter and a mediocre machinist. All of which reminds me, as I visit one foundry after another, that many of the cleaning departments I see kind of put one in mind of the dishwashing corner of the kitchen of a second-rate restaurant. While it is true that snagging castings, grinding them and cleaning in one form or another, even at their best don't have much sex appeal, it is also true that all roads in the foundry sooner or later meet in the cleaning room, where we finally find out what we've got.

While I realize that this is no great discovery, I can't help but think, what a pity it would be for a foundry gang to look upon the cleaning department or nook as one of those necessary evils like dishwashing that had to be tolerated. It seemed to me that if such a viewpoint meant that the cleaning department was a spot where only those who couldn't get anything else to do worked and where you almost had to bribe somebody to head it up, such a foundry was bound to miss a lot of bets.

Speaking as an amateur, I imagine it would pay off big if we could invent some new title like "Snagologist" which would lift cleaning up to the level of the respectability it deserves. I see one of these Snagologists, with his hair combed and small flower in his button hole, hobknobbing around with the elite, worming his way into their confidence to a point where he would tip them off to this, that and the other. I can see this dude getting into that zone between scrap and barely passable production where wasteful practices go on for years just because they aren't bad enough to holler for attention. I can see everybody and their uncle running to this fellow for darned good and down-to-earth suggestions.

The more I think about this Snagologist the more certain I am that he would have to be a Jack-of-all-trades foundry nut something on the order of the fellow who heads up the cleaning department in the Lee Hobby Foundry, only much younger and a whole lot better.

Are you getting the most out of your SIMPSON MIXERS?

THIS NEW BOOKLET WILL SHOW YOU HOW TO CUT COSTS

IF you are looking for ways to increase output and lower production costs *without* purchasing new major equipment, this new booklet will show you how to effect a modernization program in easy, economical steps.

Specifically, this booklet shows you how to bring your Simpson Mixers up to date, through the addition of the newest "National" design and engineering developments.

It is important to remember that you can modernize your existing Simpson Mixers right in your own foundry, with a minimum of labor and expense. Thus, you can restore, or even improve, their original performance without having to purchase entirely new mixers. *Write for your copy of Bulletin 503 today!*

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Manufacturers and Selling Agents for Continental European Countries—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd., Sydney, Australia

NOW! an improved HANDY SANDY
to save even more time for the molder

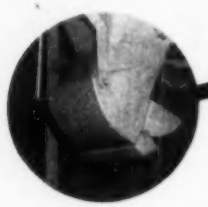
- **MORE AUTOMATIC**
- **MORE VERSATILE**
- **MORE MOLDS PER MAN**

30% to 70% more molds per man — that's been the record wherever the Handy Sandy has been used. It puts the sand overhead so the molder has no shoveling to do. He devotes all his time to molding. AND NOW, the Handy Sandy is even more automatic and more versatile than before. It turns itself off when the hoppers are full. It has an adjustable feed to compensate for different types of sand and a means of proportioning the sand for unequal requirements in Twin Hopper installations.

Give your molders a break — give them a Handy Sandy and watch your profits grow. Airmail your request for full details today.

SAND DIVERTER

In Twin Hopper installations, an adjustable diverter proportions the amount of sand going into each hopper to compensate for unequal requirements.

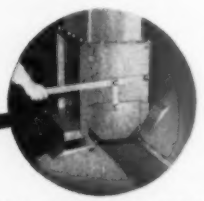


DRIBBLE GATE

A new development in overhead hopper gates that seals tightly when closed, prevents particles of sand from dropping into prepared mold.

AUTOMATIC SHUTOFF

The molder just starts the machine and forgets it. When the hoppers fill with sand to a predetermined level, the Handy Sandy shuts off automatically.



ADJUSTABLE FEED GATE

The feed of the sand to the elevator of the Handy Sandy can be varied quickly to compensate for varying conditions or types of sand.

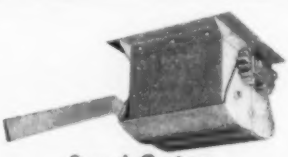
other Standard NEWAYGO equipment that will help you put your floor space to work more efficiently

Foundry Turntable

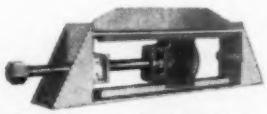
Rotary Plate Feeder

NEWAYGO Mill

NEWAYGO Aerator



Sand Gates



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FOUNDRY EQUIPMENT GROUP

Discusses Problems at Annual Meeting

By FRANK G. STEINEBACH
Editor
THE FOUNDRY

ANNUAL meeting of the Foundry Equipment Manufacturers' Association held at the Greenbrief, White Sulphur Springs, W. Va., Oct. 12 to 14, featured a discussion of Washington defense organizations and controls, reports of various association committes, consideration of subjects of joint interest to FEMA and the AFS, and a forum on present trends in the industry.

The following were elected to the board of directors: Wayne Belden, vice president, Ajax Flexible Coupling Co., Westfield, N. Y.; E. A. Borch, secretary and general manager, National Metal Abrasive Co., Cleveland, and Leon Miller, vice president, Osborn Mfg. Co., Cleveland. The new board of directors elected the following officers: President, C. V. Nass, vice president, Beardsley & Piper Division, Pettibone-Mulliken Corp., Chicago; vice president, A. J. Grindle, vice president, Whiting Corp., Harvey, Ill.; executive secretary-treasurer, Arthur J. Tuscany, Cleveland.

In opening the 32nd annual meeting, John Hellstrom, president of the association and vice president of American Air Filter Co., Louisville, expressed the need for equipment manufacturers to keep up with the important developments in the industry. Such developments may change the production trends and therefore have a profound influence on the equipment manufactured by association members. Mr. Hellstrom also stressed the problems created by the shortages of raw materials, the Washington controls, inflation, and other factors. He indicated that the Foundry Equipment Manufacturers' Association has an important job to do in furthering the present national defense program.

A symposium on "The Washington Picture" was presided over by Thomas Kaveny Jr., Herman Pneumatic Machine Co., Pittsburgh. Lee C. Wilson, Reading, Pa., and former consultant, Foundry Equipment and Supplies, Production Division, National Security Resources Board, outlined the "Industrial Mobilization Plan for Foundry Equipment and Supplies" which was developed by the NSRB and discussed and approved by the Subcommittees on Foundry Equipment and Foundry Supplies of the Munitions Board. Mr. Wilson stated that, due to the splendid co-operation of the society and members of the industry, the report was broad in scope and also contained recommendations as to orders, etc., that should be available in time of emergency.

Frank G. Steinebach, editor, THE FOUNDRY, discussed the various organizations in government participating in the defense program, including the Munitions Board, the National Security Resources Board, and the National Production Authority. He indicated the setup of the Machinery Division which should be influenced to include the work on foundry equipment and supplies.

In closing, Mr. Kaveny emphasized the importance of the work in Washington, paid tribute to the excellent job that was done by Mr. Wilson in preparing the mobilization plan, and expressed the hope that the National Production Authority would see fit to utilize this report to the fullest extent.

Graduates Are Placed

Claude B. Schneible, president, Claude B. Schneible Co., Detroit, and president, Foundry Educational Foundation, reported on the progress made by the FEF. He stated that during the past three years 468 engineering graduates were hired by the foundry industry and 497 were assigned to summer jobs. These students come from 35 different uiversities but in excess of 85 per cent of the total came from the 12 FEF schools. While the FEF has virtually reached the limit of its service capacity to the 12 schools now in the program, expansion of its influence will continue. In the 12 FEF schools, approximately 5000 engineers were graduated and these young men have had a better look at foundry processes than at any time in the history of the industry. The FEF trustees firmly believe that con-

(*Concluded on page* 120)

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A. J. TUSCANY
Executive Secretary-treasurer

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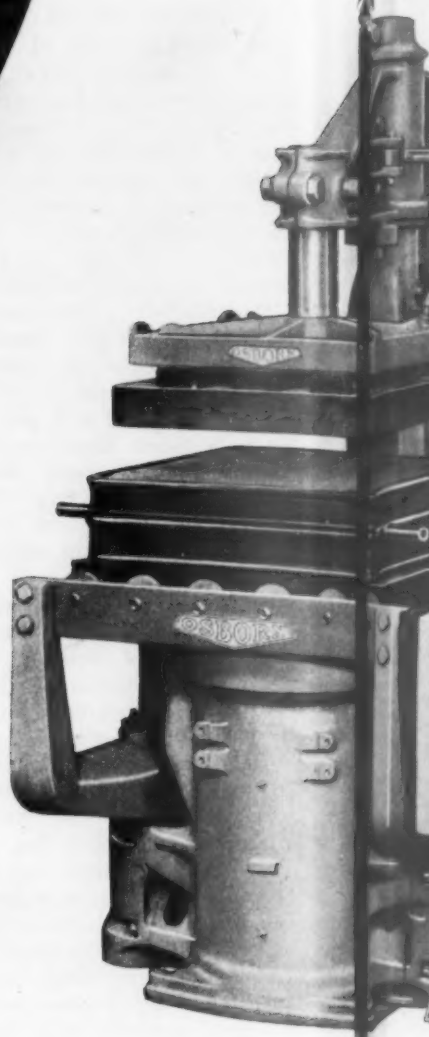

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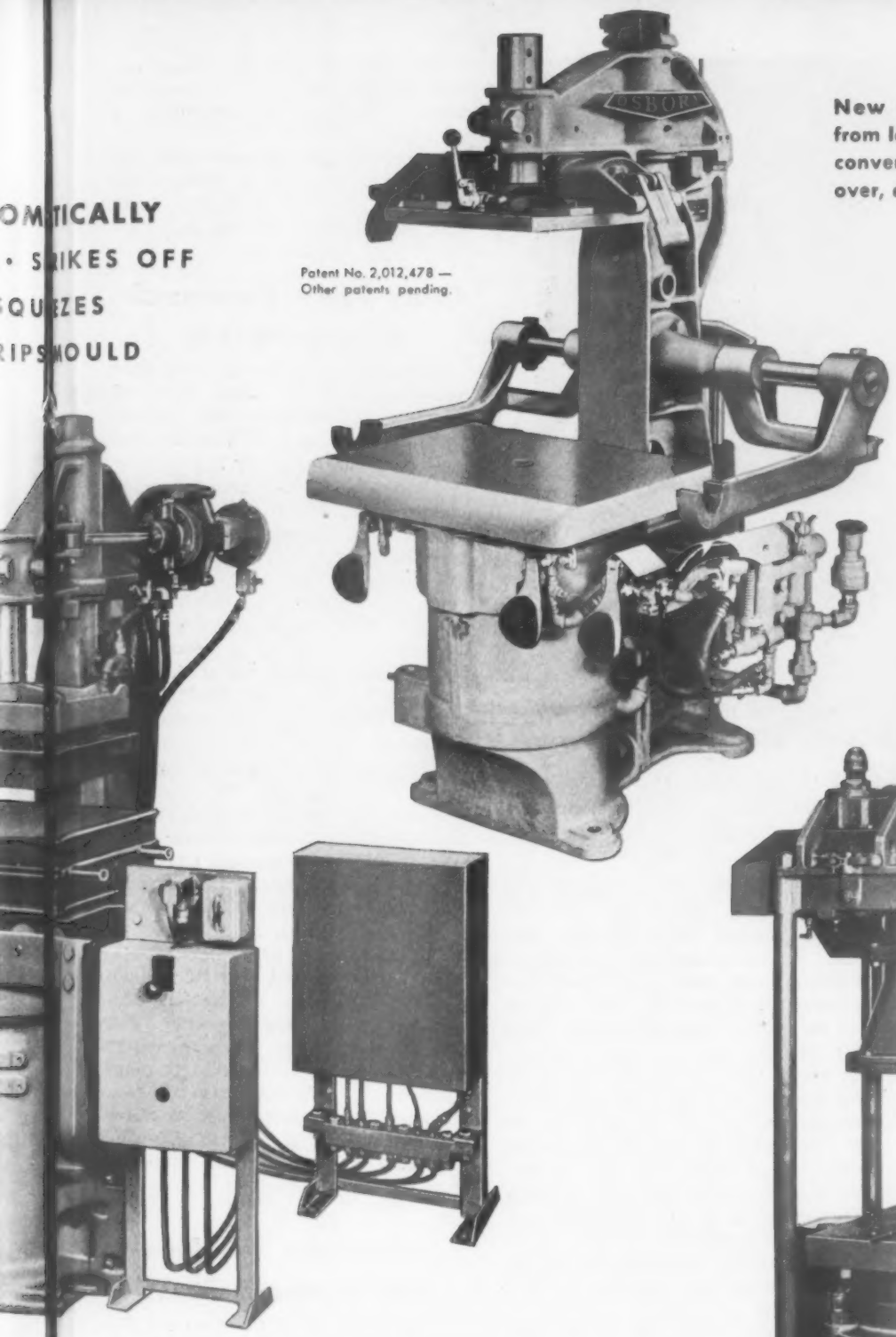

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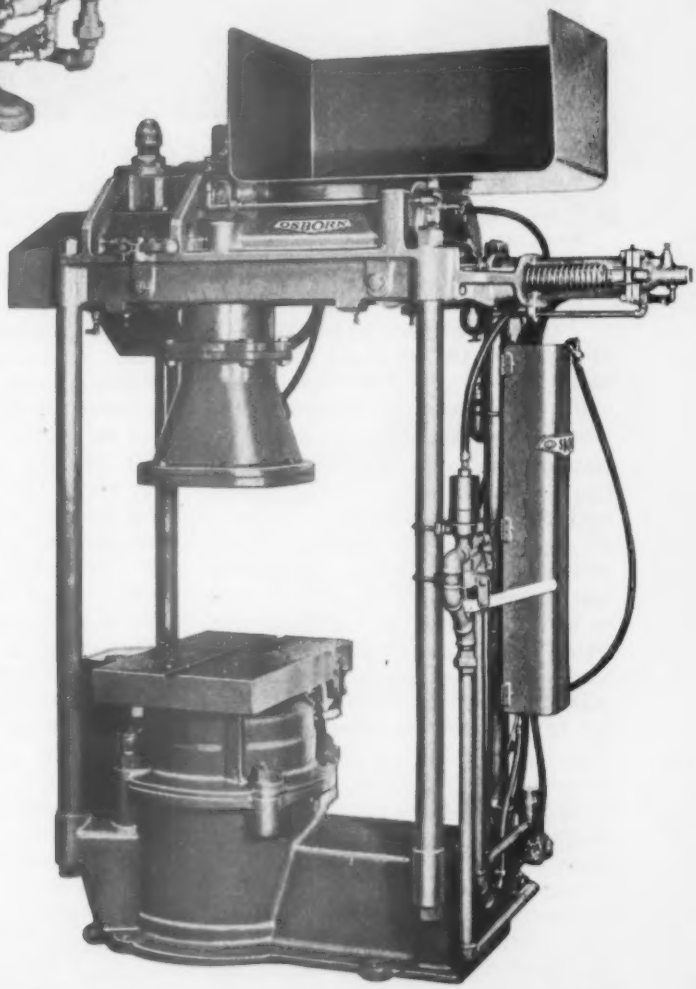

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FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

FEMA meeting speakers, left to right: Frank G. Steinebach, *The Foundry;* Walton L. Woody, National Malleable & Steel Castings Co., Cleveland; Claude B. Schneble, Claude B. Schneible Co., Detroit; Lee C. Wilson, Reading, Pa.; Thomas Kaveny Jr., Herman Pneumatic Machine Co., Pittsburgh

(*Concluded from page* 117)

tinuation of the program will eventually extend its influence to virtually all graduating engineers.

Walton L. Woody, vice president, National Malleable & Steel Castings Co., Cleveland, and president, American Foundrymen's Society, presented several points of mutual interest to the two organizations. Mr. Woody first discussed the program for work in safety, hygiene and air pollution which will require the raising of funds to the extent of $35,000 per year for a period of ten years. Walter L. Seebach, president, Superior Foundry Inc., Cleveland, and vice president of the AFS, is chairman of the committee. Mr. Woody also outlined the project of building a home for the AFS as a means of reducing overhead costs and enabling the society to render greater service. The speaker asked for support of the members of the FEMA in furthering both of these projects.

The Saturday morning session was devoted to a study of present business activity. E. A. Borch, chairman of the Statistical Committee, presented an interesting discussion on how the present situation is affecting the equipment industry. He indicated that orders increased 245 per cent during June, July and August as compared with January, February and March, but that the increase in shipments was only 15 per cent. Production will expand rapidly to take care of this situation. He suggested that producers watch the relation of new orders to shipments, rather than the backlog, to determine accurately what is taking place. He emphasized the importance of statistics gathered through the society as an aid in determining trends and permitting accurate controls. Statistics may be very important in presenting facts to various government agencies in connection with defense work. Following this presentation, the members in attendance reported on factors connected with the present business picture. In each case the trend is up, but the scope varies considerably.

Anthony DeYoung, advertising manager, Whiting Corp., and chairman of the Public Relations Committee, presented an interesting report on the activities of that group. Mr. DeYoung said the new insignia and slogan is being used widely, that the speaker's bureau is being continued as a service to the entire foundry industry, that the executive secretary-treasurer has continued appearances before various groups, and that the society office is providing news releases on the activities of the organization.

Annonucement was made that the 1951 annual meeting of FEMA will be held at the Homestead, Hot Springs, Va., Oct. 31-Nov. 2.

Gray Iron Research Group Meets

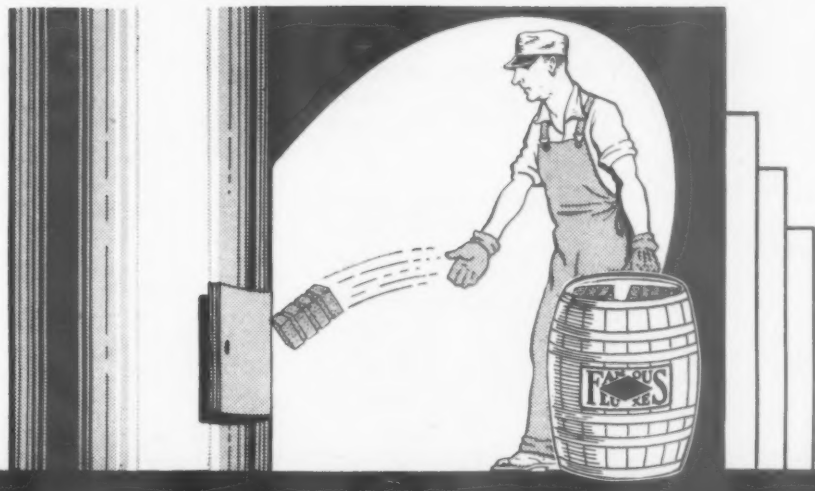
Operators' group of the Gray Iron Research Institute held its 34th meeting at Saginaw and Vassar, Mich., Oct. 5 and 6. The two-day meeting was attended by 75 men from member plants and included plant visitations to the Foundry Division, Eaton Mfg. Co.—a member of the institute—and to the Chevrolet gray iron foundry. The technical sessions included discussions on the improvement of the machinability of gray iron castings and the influence composition and temperature of the castings at the time of shaking out exert on the strength and hardness of castings.

Following the election of new officers, J. E. Reynolds, U. S. Pipe & Foundry Co., Bessemer, Ala., retiring chairman, turned the meeting over to the newly elected chairman, Erwin Deutschlander, Worthington Pump & Machinery Corp., Buffalo, N. Y. J. L. Brooks, Sparta Divisien, Muskegon Piston Ring Co., Sparta, Mich., was elected vice chairman and H. W. Lownie Jr., Battelle Memorial Institute, Columbus, O., was re-elected secretary. Three members were elected to the Research Committee: A. W. Schneble, Advance Foundry Co., Dayton, O.; S. C. Clow, James B. Clow & Sons, Coshocton, O.; and A. D. Barczak, Superior Foundry Inc., Cleveland.

Scientific Studies Are Summarized

Annual Report of the National Bureau of Standards for 1949, is a 101-page book summarizing scientific investigations carried on at NBS. It is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, for 75 cents.

Thirteen bureau divisions studied electronics, applied mathematics, atomic and radiation physics, radio propagation, electricity and optics, metrology, heat and power, chemistry, mechanics, organic and fibrous materials, metallurgy, mineral products, and building technology. A fourteenth division dealt with commodity standards.



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CLEANSES MOLTEN ALUMINUM so that you pour clean, tough castings. No spongy or porous spots even when more scrap is used. Thinner yet stronger sections can be poured. Castings take a higher polish. Exclusive Formula greatly reduces obnoxious gases, improves working conditions. Dross contains no metal after this flux is used.

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Ingot Brass and Bronze

(Shipments in net tons)

	1949	1950
Jan.	19,456	18,874
Feb.	15,026	18,487
Mar.	14,550	22,494
Apr.	10,695	22,118
May	11,114	23,643
June	9,696	25,093
July	10,220	21,609
Aug.	14,194	29,689
Sept.	16,208	28,811

Source: Ingot Brass and Bronze Industry.

Foundry Production Workers

Estimated Number

	July 1950	June 1950	July 1949
Iron & Steel	202,600	200,600	175,900
Nonferrous	78,800	77,700	58,700
Average Weekly Earnings			
Gray Iron	$63.74	$64.19	$52.63
Malleable Iron	64.33	65.71	53.49
Steel	65.45	65.84	55.57
Nonferrous	65.12	66.64	60.57
Average Weekly Hours			
Gray Iron	41.2	41.2	36.4
Malleable Iron	41.0	41.8	35.1
Steel	41.5	41.7	36.8
Nonferrous	40.8	41.6	38.8

Labor Turnover Rate (July)
(Per 100 employees)

	Total Accession	Total Separation	Quit	Layoff
Gray Iron	4.8	3.1	1.6	0.7
Malleable Iron	5.7	3.5	2.6	0.2
Steel	6.7	2.9	1.8	0.5
Nonferrous	5.0	3.4	2.5	0.4

Source: Bureau of Labor Statistics.

Index of Foundry Equipment Orders

Foundry Trades Only

(Net Orders Closed, New Equipment)

	1949	1950
Jan.	149.9	159.3
Feb.	144.4	113.1
Mar.	190.8	225.2
Apr.	172.0	160.6
May	121.9	294.9
June	164.9	622.7
July	146.6	401.8
Aug.	127.1	693.6
Sept.	166.6	483.8
Oct.	133.5	....
Nov.	270.4	....
Dec.	201.0	....

Note: Figures are percentages of the base period 1937-1939 taken as 100 per cent (monthly average). Source: Foundry Equipment Manufacturers Association.

Shipments of Castings

(Reported by Bureau of the Census)

Gray Iron

(Net tons)

	Shipments		Unfilled
	Total	For Sale	*Orders
1948			
Total	12,785,909	7,131,405	.....
1949			
Aug.	872,013	445,981	1,048,308
8 mo.	7,372,077	3,828,129	.....
Sept.	880,647	459,014	980,070
Oct.	715,685	397,939	955,100
Nov.	718,703	395,107	938,629
Dec.	862,172	440,409	892,458
Total	10,549,284	5,517,527	.....
1950			
Jan.	913,321	449,577	914,185
Feb.	864,189	416,594	873,455
Mar.	995,782	500,195	921,575
Apr.	981,126	483,862	922,255
May	1,095,111	572,887	977,833
June	1,136,129	613,084	1,039,619
July	961,450	507,867	1,286,579
Aug.	1,201,569	677,134	1,670,380
8 mo.	8,148,677	4,221,200	.....

Steel

(Net tons)

	Shipments		Unfilled
	Total	For Sale	*Orders
1948			
Total	1,760,032	1,335,295	.....
1949			
Aug.	89,849	59,412	143,566
8 mo.	930,195	657,417	.....
Sept.	87,117	55,853	127,664
Oct.	71,295	48,263	124,817
Nov.	76,820	50,685	117,865
Dec.	85,033	53,079	122,887
Total	1,250,460	865,297	.....
1950			
Jan.	88,821	57,996	142,484
Feb.	91,827	62,045	165,186
Mar.	111,772	77,588	185,611
Apr.	106,964	75,133	201,643
May	117,944	83,845	198,078
June	131,097	94,637	206,799
July	98,269	68,874	255,418
Aug.	128,369	94,413	329,944
8 mo.	876,348	614,531	.....

Malleable

(Net tons)

	Shipments		Unfilled
	Total	For Sale	*Orders
1948			
Total	933,265	525,212	.....
1949			
Aug.	58,121	30,327	61,330
8 mo.	607,483	318,030	.....
Sept.	60,723	30,781	57,512
Oct.	57,150	28,582	54,322
Nov.	49,439	25,250	55,795
Dec.	57,379	29,679	60,835
Total	713,330	371,214	.....
1950			
Jan.	62,874	32,918	62,307
Feb.	60,386	31,249	67,049
Mar.	66,259	38,639	69,866
Apr.	69,822	36,279	76,250
May	76,161	42,432	77,074
June	82,345	46,613	86,783
July	67,514	37,198	105,300
Aug.	86,021	50,019	132,374
8 mo.	571,382	315,347	.....

Aluminum

(Thousands of pounds)

	Shipments				Unfilled
	Total	Sand	Perm. Mold	Die	*Orders
1948					
Total	424,490	139,781	161,334	118,738	.....
1949					
Aug.	23,997	9,048	8,326	6,119	38,130
8 mo.	194,806	67,986	67,465	54,596	.....
Sept.	27,546	9,923	9,491	7,623	38,179
Oct.	29,071	9,634	9,923	8,908	37,881
Nov.	26,317	9,212	8,315	8,348	36,846
Dec.	26,762	10,070	7,714	8,430	36,921
Total	304,616	106,825	102,908	88,019	.....
1950					
Jan.	28,801	9,646	9,400	9,052	40,591
Feb.	28,887	10,171	9,358	8,851	44,235
Mar.	35,845	13,035	11,094	10,870	47,350
Apr.	33,356	11,091	10,656	10,795	49,952
May	36,031	11,526	11,928	11,799	52,580
June	37,600	12,677	11,825	12,173	53,309
July	30,152	9,613	9,808	9,943	63,892
Aug.	39,852	14,117	12,682	12,207	82,564
8 mo.	270,456	91,876	86,751	85,622	.....

Magnesium

(Thousands of pounds)

	Shipments		Unfilled
	Total	For Sale	*Orders
1948			
Total	8,214	7,488	....
1949			
Aug.	753	712	3,107
8 mo.	6,259	5,820	....
Sept.	727	691	3,015
Oct.	796	763	3,050
Nov.	801	769	2,399
Dec.	781	738	2,216
Total	9,364	8,781	....
1950			
Jan.	814	762	2,237
Feb.	735	676	2,218
Mar.	903	849	2,322
Apr.	799	751	2,305
May	810	762	2,282
June	758	698	2,482
July	727	677	3,356
Aug	1,147	1,078	4,855
8 mo.	6,693	6,253	....

Copper-base Alloys

(Thousands of pounds)

	Shipments			Unfilled
	Total	Sand	Perm. Mold	*Orders
1948				
Total	1,030,825	930,790	59,009	.....
1949				
Aug.	58,055	53,203	2,929	26,071
8 mo.	479,821	431,402	26,369	.....
Sept.	60,771	55,221	2,729	26,527
Oct.	58,249	52,861	2,316	23,634
Nov.	61,818	56,669	2,811	23,625
Dec.	63,873	58,291	3,086	23,435
Total	725,318	654,444	37,311	.....
1950				
Jan.	65,585	58,878	3,440	25,216
Feb.	67,029	60,257	3,626	26,923
Mar.	80,442	71,876	4,693	27,631
Apr.	72,318	64,773	3,848	28,769
May	79,108	71,605	3,751	30,880
June	83,023	74,990	3,896	32,808
July	69,033	62,414	3,789	39,906
Aug.	93,942	85,756	4,379	52,513
8 mo.	609,979	550,549	31,422	.....

* For sale only.

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NON-FERROUS FOUNDERS' SOCIETY

Holds Annual Meeting in Boston

By BEN K. PRICE
New York Editor
THE FOUNDRY

NONFERROUS casting makers anticipate months of good activity ahead, in view of the expanding defense program. But the going is likely to be rugged what with increasing government controls, higher taxes, shortages in raw material and perhaps above all, a growing stringency in skilled manpower.

Opinions to this effect were voiced by members of the Non-ferrous Founders' Society at their annual meeting at the Hotel Statler, Boston, Oct. 13-14, at which special attention was directed not only to business conditions but to matters of costs and other managerial problems.

However, foundrymen still look for some decline from present active levels unless defense orders develop fast enough to offset the adverse affect of credit restrictions on housing and civilian hard goods. This decline could come shortly after the turn of the year, at least temporarily, some believe.

Following a year of declining business in 1949, nonferrous foundries experienced a quickening in activity, especially following outbreak of the Korean war. In some sections business had increased 30-35 per cent since late June and even higher, although reflecting little in the way of actual defense buying. Rather the gain was due primarily to anticipatory buying—out-and-out "scare" buying in many cases.

At Cincinnati, for instance, where there had been an increase of about 35 per cent, less than 5 per cent was directly attributable to defense buying. Actually, Indianapolis business jumped 50 per cent, with no evidence of war contracts. On the other hand, fairly good demands from the aircraft industry, stimulated by the emergency, contributed to an active business at Connecticut nonferrous foundries.

Virtually all districts throughout the country have shown substantial improvement, although the gain in the Philadelphia area was rather disappointing, some foundries there still operating on a 4-day basis at the time of the report.

J. D. Zaiser, Ampco Metal Co. Inc., Milwaukee, was named society president, succeeding Walter M. Clark, D. W. Clark & Co., Boston. L. H. Durdin, Dixie Bronze Co. Inc., Birmingham, formerly second vice-president, was named first vice-president to succeed Mr. Zaiser; and Robert Langsenkamp, Langsenkamp-Wheeler Co., Indianapolis, is second vice-president. James W. Wolfe and Ruth Anne Windsor were re-elected secretary-treasurer and assistant secretary-treasurer, respectively.

Mr. Langsenkamp, Raymond E. Bietry, B. & S. Bronze Foundry Co. Inc., Brooklyn, and Leo G. Smith, Lakeside Bronze Co., Buffalo, were elected to the directorate, to succeed George B. Hazen, Brass Foundry Co., Peoria, Ill.; John C. McCallum, McCallum Bronze Co. Inc., Buffalo; and the late William E. Paulson, Thomas Paulson & Son Inc., Brooklyn.

A change in by-laws was enacted shifting the time of the annual meeting from fall to spring.

The first day of the convention was given over to meetings of the directors and various committees; the second to two general sessions, a luncheon and the annual dinner. In the morning of the second day were reports of the president and secretary-treasurer and reports by Mr. Zaiser of the membership committee, Mr. Durdin of the business practices committee, Mr. Hazen, of the labor-relations committee and Fred Haack Jr., Capital Brass & Aluminum Foundry Co., Chicago, of the committees on chapter activities, nominations and public relations. The afternoon session was devoted to questions on government controls, NPA orders and foundry costs.

Comm. Clarence Cisin, U. S. N., Chief of Industry-Management section, National Organizations Branch, Department of Defense, Washington, predicted that for the next few years "we are going to be tremendously active" in military preparations, whether the war is hot or cold. Hence, he said, close cooperation between government and industry is going to be necessary.

As guest speaker at the luncheon, he commented on the aims of his office toward developing closer relationship between the defense department and trade associations. He remarked there are about 1800 to 2000 associations and that some time ago his office sent invitations to officers of 70 of these organizations to visit Washington and work with his department in an effort to set

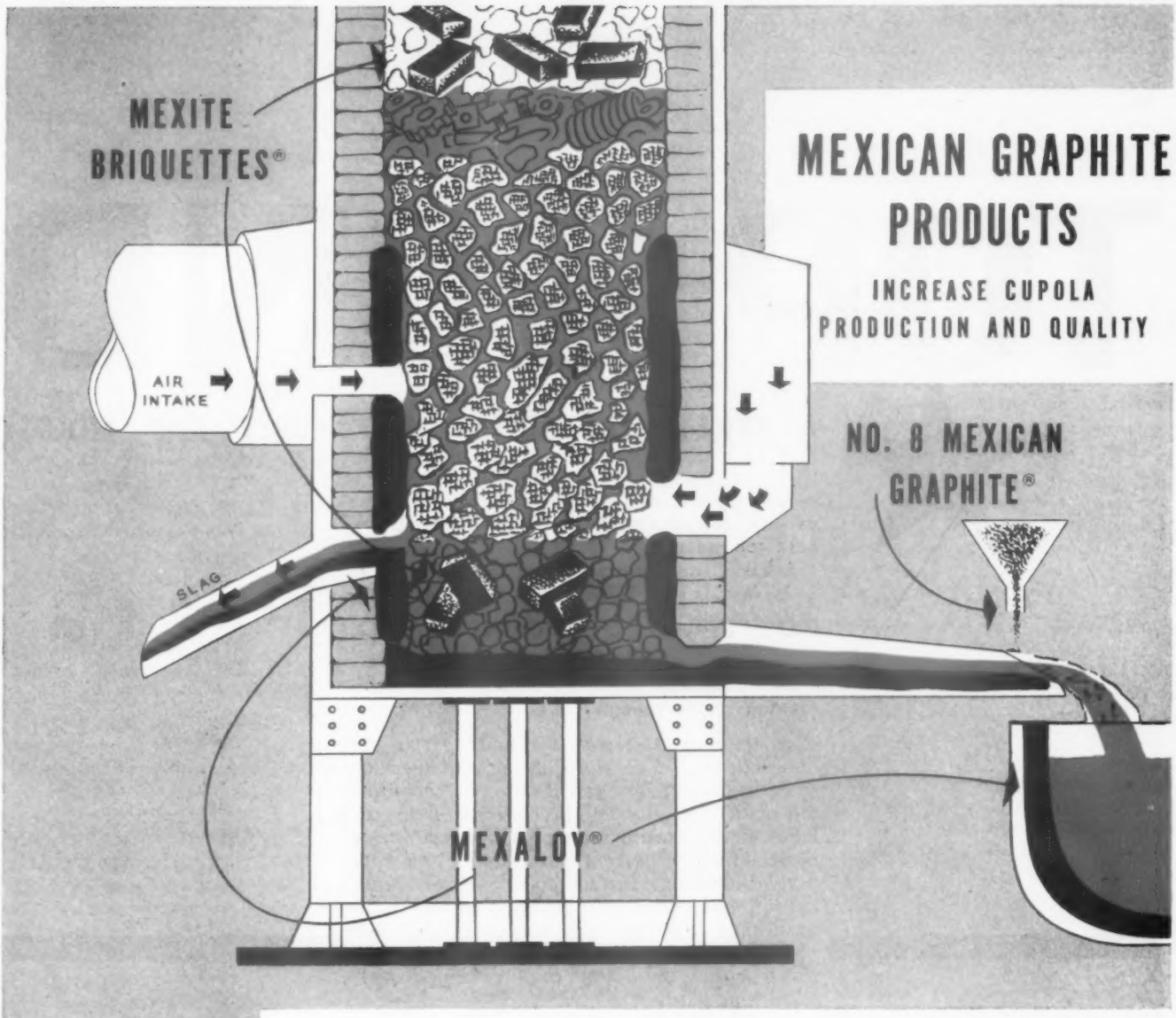
(*Concluded on page* 127)

J. D. ZAISER
President

L. H. DURDIN
First Vice President

ROBERT LANGSENKAMP
Second Vice President

J. W. WOLFE
Secretary-treasurer



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NO. 8 MEXICAN GRAPHITE®

MEXITE BRIQUETTES. One 4-lb. Mexite Briquette provides the same carbon content as 50 lbs. of pig iron when introduced into the cupola charge. Not only do Mexite briquettes sharply reduce melting costs per ton; they also *reduce the range of carbon content fluctuation* and give a steadier carbon analysis, a particularly vital factor when high percentages of steel are charged.

MEXALOY, applied to cupola linings, ladles, and spouts, resists molten metal and slag and keeps metal free from refractory inclusions. Its natural lubricating action provides low friction surfaces which part easily from metal and slag. A Mexaloy mixture is *easily applied to any clean surface.* Because it will not melt or change character under intense heat, Mexaloy gives longer refractory life with lower maintenance cost.

No. 8 MEXICAN GRAPHITE is used for ladle additions to treat grey cast iron. Trickled into the cupola spout as metal falls into the ladle or with a direct ladle addition, it greatly reduces chill and hardness, *producing castings of increased machineability.* Normally only 2 lbs. of No. 8 need be added per ton of molten metal — a cost of only ten cents per ton — to assure castings which require no annealing. Write today for complete information on how Mexite Briquettes, Mexaloy, and No. 8 Mexican Graphite will give you better castings for less money.

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THE UNITED STATES GRAPHITE COMPANY

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TOP-BOND

A SPRAY FOR GREEN SAND CORES AND MOLDS

Another United star performer, TOP-BOND shows excellent penetration, and will air-dry to a firm, hard top surface.

Below is an extract from a letter written to us by Mr. D. W. Talbott, Vice President of the

COOPER ALLOY FOUNDRY CO.
Hillside, N. J.

manufacturers of corrosion, abrasion and heat-resisting alloy castings:

"You will be interested in knowing that we have eliminated all the dipping and washing of cores for our squeezer production by spraying with Top Bond. **This has saved us the labor of two core makers plus an extra drying cycle.** *Many of our cores are blown and have a relatively soft surface which breaks down considerably in handling from our core room to storage to molds. The use of TOP-BOND protects this surface and gives an interior finish equal or better than obtained from silica type washes.*

We are also using TOP-BOND as an air dry spray in our green sand molds. This has permitted us to use green sand where dry sand was formerly considered imperative."

TOP-BOND is particularly suited for use with steel. Cores which are processed for faster collapsing are often soft enough at the surface to wash or allow metal penetration. Sprayed with TOP-BOND, a clean line of cleavage is created between core and casting. Tolerance can be held to closer limits. Cleaning costs are reduced. Hours of preliminary machining will be saved. "TOP-BOND shows excellent value for other metals as well and is recommended both for baked and green sand cores or molds".

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United Oil Manufacturing Co.

E R I E, P A.

(*Concluded from page* 124)

up a program of liaison. Representatives of 66 responded and a committee of 21 was formed to represent the trade associations. This committee is now ready to function, he said.

The objectives of his office are (1) to provide a two-way flow of information; (2) to set up for the associations through their committee of 21 general conferences with defense officials if the problems are sufficiently large to warrant it, or interviews with proper officials if the problems are smaller and action can best be served in that way; and (3) to provide military speakers on pertinent defense matters for conventions or general meetings.

Mr. Wolfe led the discussion on NPA Regulations No. 1, covering inventory control, and No. 2, dealing with military priorities. He pointed to the need of various clarifications, especially in the latter and emphasized that these regulations are but forerunners of numerous other controls to follow.

Need Direct Contact

He stated it would be desirable for the society to establish direct representation in Washington, once the preparedness program got under fuller swing. There will be many matters, he emphasized, that will require prompt attention as well as follow-through, as more and more controls and regulations are set up. Meanwhile, to supplement such information as his office will be able to provide, he suggested that members keep in close contact with their local Department of Commerce and Chamber of Commerce offices.

He predicted an eventual rollback in prices, predicated on those prevailing in the government-designated base period of late last spring, with due allowances at least for interim advances in labor costs. This and other developments, he believes, will unfold rapidly once the new Economic Stabilization Agency has had full opportunity to study the situation and draw up policies.

The society, it was revealed, has proposed a set of terms and conditions of sale for the nonferrous foundry industry which is now being studied by the Purchasing Agents Association with a view to possible acceptance as standard.

William A. Gluntz, Gluntz Brass & Aluminum Foundry Co., Cleveland, discussed a long-range cost program to tie in with new government regulations. Important cost factors to consider in relation to DO priority orders, he said, are (1) quantities, (2) pattern equipment, (3) metal cost and (4) weight of castings. He believes every possible operation should be based on direct labor cost and suggested also that it might be wise for the foundrymen to have a special audit made for the May-June base period.

Features of the annual dinner were address of welcome by S. Oscar Swangren, chairman of the Boston Chapter, introduction of new officers by the retiring president, Walter M. Clark, and remarks of the dinner speaker, William Sutcliffe, dean of the College of Business Administration, Boston University. Speaking on the subject "Fifty Years in Review" Mr. Sutcliffe outlined major economic and social trends in this country.

Mr. Clark was host to officers and directors at a shore dinner outing at Buzzards Bay, Mass., the day after the convention.

Book Review

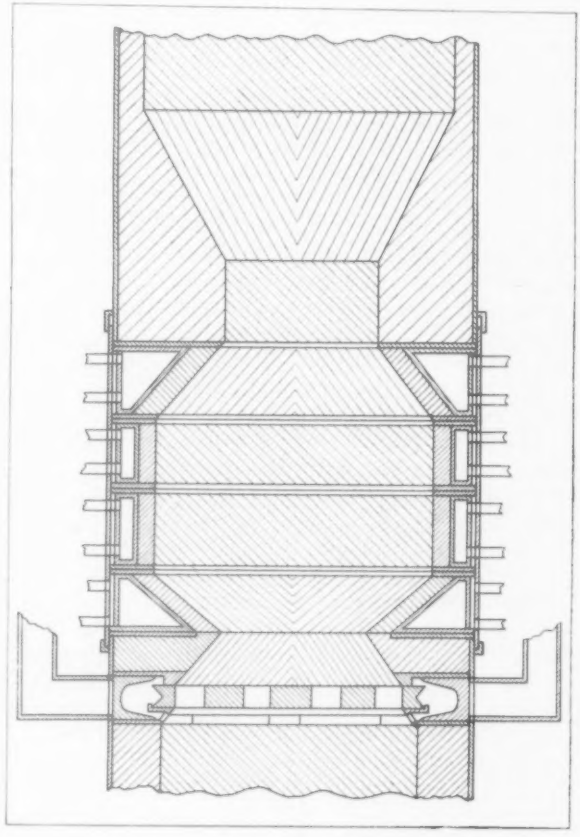
Handbook on Radiography, published by Eldorado Mining and Refining (1944) Ltd., Ottawa, Canada, 71 pages, 6 x 9 in., paper. Price $2.

Purpose of this manual is to provide an introduction into that section of the industrial radiography field concerned with the use of penetrating radiations from naturally occurring and artificially produced radioactive materials. Sections of the book are presented under the headings: Introduction, Source of Radiation, Fundamentals of Radiography, Equipment Necessary for Radiography, Determination of Exposure Time, Applications and Interpretations, Radioactive Isotopes, and a bibliography.

Methods Engineering Council, 718 Wallace Ave., Pittsburgh 21, held industrial night open house at its new office building Oct. 10.

WATER COOLS LINING IN CUPOLA BOSH

A cupola with new and improved tuyere system recently designed by F. J. Zippler 700 W. North Ave. N. S., Pittsburgh, and shown in the accompanying illustration, includes a series of doors and frames in the lower portion of the cupola shell to permit withdrawal and insertion of sectional water jackets. The water jackets are reinforced with refractory material on the inner face. The upper bosh walls serve as a guide for the descending raw materials, to prevent any molten iron and slag from coming into contact with the water-cooled sections in and about the melting zone, and to protect the water jackets.



The main tuyere section comprises an auxiliary tuyere arrangement to preheat molten hot iron to a higher temperature, and to retain this higher temperature for a considerably longer period than the molten iron coming down in other type cupolas.

It is claimed that the new design and tuyere construction will promote faster melting, give much longer melting time and will produce good hot iron with greatly reduced coke consumption, also improve the composition in the finished product. The water jackets may be omitted where the cupola is not in operation for a long period. This is due to the particular shape of the bosh lining in and about the melting zone. The inventor claims that the new furnace will give 200 per cent longer life than any other type of cupola.

Around THE COUNTRY

CHICAGO—One of the leading foundry coke sellers here, Hickman, Williams & Co., is exploring the possibility of constructing new coke capacity. Its president, A. J. Johnston, told FOUNDRY that new ovens might cost approximately $100,000 per oven, or three to four times "normal" cost of such construction. To determine whether such expenditure is feasible he is sounding out foundrymen on their attitude toward premium prices of coke from the facility. He guesses that roughly $5 extra per ton on such coke might be required to make the idea sound.

District foundries are operating at high levels, but few are able to get enough pig iron to increase their melt. Automobile shops are regarded in the trade as the only group able to pile castings in excess of current consumption. Iron sellers generally are resisting demands from this group for greater iron allotments. Cast scrap market is especially buoyant. Number of DO rated orders extended to iron purchases currently is insignificant.

Chicago Foundrymen's Association, representing 30 ferrous and nonferrous foundries in the Chicago area, has granted a wage increase of 5 cents an hour to members of the International Molders & Foundry Workers Union—AFL. The raise was retroactive to Oct. 30. The equivalent of an additional 8 cents an hour will be applied to the wage rate effective May 1, 1951.

The increase was voluntarily made, no provision having been included in the existing contract for reopening. In amending the present contract, which had been scheduled to expire next May, its terms were extended, new expiration date being May 1, 1952.

* * *

PHILADELPHIA — District gray iron foundries are operating at the highest rate this year, generally five or six days a week. In the latter cases it is usual procedure to have a long heat Friday night and then mold on Saturday. This schedule is also largely true at steel foundries and the malleable plants, reflecting particularly the needs of the expanding freight car building program.

Most iron jobbing foundries now have about a two-month backlog and the pipe foundries an even more extended schedule. DO priority business is increasing, mostly for tooling orders and materials handling equipment, it is said. Rated work, however, still is relatively small.

Labor presents less of a supply problem than do raw materials, but the trend is toward scarcity and some predict that by end of the first quarter, shortage of skilled labor will prove to be a veritable bottleneck.

Most of the larger ferrous foundries are supplementing their domestic pig iron supply with foreign iron, which is being bought at anywhere from $56 to $60, shipside, duty paid. Some foundrymen report it difficult to place orders with the more established importers for shipment before late February or early March. Shortage of iron has resulted in greater pressure for cast scrap and this in turn has forced the scrap market higher. No. 1 machinery cast, for instance, was holding around $55, delivered early in November. Eastern pig iron prices have been unchanged since mid-October.

* * *

NEW YORK—Gray iron and nonferrous casting producers look for some slowing down from the current active rate late in December and January. Holiday influences will probably be a factor at the yearend, but most foundrymen believe that anticipatory buying, such as has been dominant since midsummer, will taper before defense requirements can take up the slack. In any event, no material slow-up is expected and some doubt if there will be any except at the holidays.

Currently producers of all types of castings are operating at about as high a level as the raw materials supply will permit. Nonferrous casting producers report a severe stringency in aluminum and while they are still able to get fair quantities of zinc and copper, they are concerned as to how long supplies will be sustained.

Pig iron stocks have been whittled down considerably and some consumers are on a virtual hand-to-mouth basis. In some instances, even where iron is known to be in transit by rail, buyers are appealing to producers to let them have truck lots to tide them over. Coke is another cause for concern, although to date there has been enough to meet the needs.

Casting prices are tending higher, especially nonferrous products, because of the continued substantial increases in the metal prices.

* * *

LOS ANGELES—Foundry activity continues to expand as casting users ask "How soon?" instead of "How much?" With backlogs ranging from 60 to 90 days, foundries now on two-shift, five-day schedules may soon follow trend established by Carleton Tibbetts' Los Angeles Steel Casting Co., and go on six-day work week. District plants previously kept clear of overtime because of the expense, now find increased demand for castings makes overtime unavoidable.

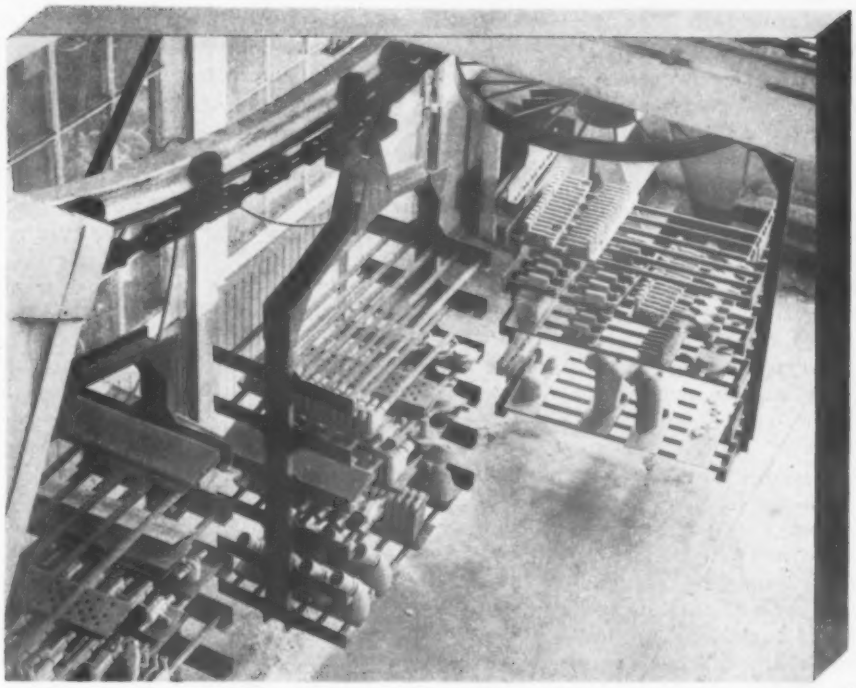
While many are semi-production shops, most district foundries are still jobbing shops, so accurate count of castings for defense work is hard to determine. Most industry observers agree that defense business is the smaller part of backlogs, greatly exceeded by accelerated civilian demand. Orders for defense are usually limited to development parts. Oil field requirements, mostly for replacement castings for field and refinery use, are much higher. Agricultural demand is up.

With little scrap or pig generated locally for their use, district foundries rely on water transportation for their supply of raw materials. Previously foundry scrap and pig had been in sufficient supply and water imports had trickled. Last month, rising foundry activity, coupled with dwindling supplies of both iron and scrap, caused off-shore imports to resume. Flow of cast scrap to melters is unsteady, and is influenced considerably by iron imports which serve to keep the lid on price of foundry scrap. No. 1 cupola cast rose from $42 to $49 a ton the last 60 days, a much smaller rise than was registered in other districts.

* * *

WASHINGTON—France can double the productivity of workers in its steel and malleable foundries by adopting American production methods. That is the opinion of at least one member of the French team brought to the United States under Economic Cooperation Administra-

(*Continued on page* 130)



mechanized handling benefits everyone

● In the Foundry Industry, as in all others, the advantages of mechanization are far-reaching. The production of more and better castings, at less cost, which is made possible by modern foundry equipment, benefits the foundry employees, management, the shareholders or owners and the purchasers of the products on which the castings are used. It might be an automobile, a home appliance, an outboard motor, a farm implement or any one of a thousand products which are made better by the use of castings. The application of modern foundry equipment, and the efficiency and economy which it creates, is bringing more good things within the reach of more people.

Well-planned conveyer systems are usually pretty important in foundry mechanization programs. Today, Mathews Engineers are making available to American and Canadian Foundrymen the benefit of long experience with foundry conveying problems. This, and the facilities of three modern plants, is yours for the asking. Write or wire today for catalogs. Engineers in all principal cities.

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(*Continued from page* 128)

tion sponsorship, Georges Daugenet, engineer, Fonderie des Ardennes a Mezieres. At a press conference attended by the team at ECA headquarters in Washington at the end of a busy five-weeks' round of visits at American plants, M. Daugenet said part of the improvement in productivity may be obtained by increased use of mechanical handling—as overhead tramrail systems for transporting molten metal directly to all pouring floors, and by taking off the backs of French molders much of the work which now mars their efficiency.

"A lesson I learned on my trip is that when a molder is permitted to stick to molding, he does more and better work as compared with our French molders who not only put up molds but pour them, get their own sand, shake out molds, etc. We certainly will launch a drive toward greater specialization in the use of labor, in the belief this will benefit not only management and labor, but French industry in general," declared M. Daugenet.

Leader of the team, Maurice Marcel Flour, technician, Acieries d'herson a Hirson, said the trip pointed the way toward modernization of French foundries. By that, he said, he did not mean mechanization entirely—for French industry has good foundry equipment available, including the modern equipment used in United States foundries. Rather, he meant the organization of the work to "coordinate time and motion." By methods alone, he said, American foundry workers greatly outproduce French foundry workers and at end of the day are fresh whereas French workers have exerted themselves more and are tired.

Gaston Fabien Martin, manager, Usines et Acieries de Sambre et Meuse a Feignies, said the American trip had shown clearly that closer contact and better understanding is necessary between management and workers at the French plants to enable the workers better to know what increased productivity is all about and how it will benefit them. If the French worker can be made to feel the spirit of the American worker, if he can derive the same satisfaction from his work, the big part of the productivity will have been solved.

The team will draw up detailed conclusions from its trip and present these in the form of a report to all French steel and malleable shops. In addition, the members will address foundry industry meetings and tell of their observations. Results from the trip, thought M. Flour, should begin to become apparent within a few months.

* * *

PITTSBURGH — Lone merchant foundry and malleable iron supplier here has been unable to meet essential requirements of customers. The spread between supply and demand of roughly 3000 tons for November is expected to widen in succeeding months as railroad freight car and other direct and indirect war programs gain momentum. It appears inevitable that some form of governmental regulation covering distribution of pig iron to preferred consumer groups will be in force before year end.

Inadequate pig iron supply has forced foundries to rely more heavily on scrap, resulting in further upward trend in prices to around $60 for No. 1 machinery cast, $54 for heavy breakable, and $67.50 for 2-foot rails. This situation also has prompted in-

(*Concluded on page* 132)

Meetings of Interest to Foundrymen

Dec. 1—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Dec. 7-9—Electric Furnace Steel Conference, sponsored by American Institute of Mining and Metallurgical Engineers, Hotel William Penn, Pittsburgh.

1951

Jan. 15-18—Plant Maintenance Conference and Show, Public Auditorium, Cleveland

Jan. 19—Malleable Founders' Society, semi-annual meeting, Hotel Cleveland, Cleveland

Jan. 22-26—American Society of Heating & Ventilating Engineers, exposition and annual meeting, Commercial Museum, Philadelphia

Feb. 8-9—Wisconsin Regional Foundry Conference, sponsored by Wisconsin Chapter of AFS and University of Wisconsin, Schroeder Hotel, Milwaukee

Feb. 22-23—Birmingham Regional Foundry Conference, Birmingham District Chapter and University of Alabama Student Chapter of the AFS, Tutwiler Hotel, Birmingham

Feb. 23—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Mar. 2—Malleable Founders' Society, eastern sectional meeting, Hotel Commodore, New York

Mar. 5-9—American Society for Testing Materials, committee week, Netherland Plaza Hotel, Cincinnati

Mar. 9-10—Ohio Regional Foundry Conference, sponsored by Ohio Chapters and Ohio State University Student Chapter of AFS, Case Institute of Technology, Cleveland

Mar. 19-23—Western Metal Congress & Exposition, Civic Auditoriums, Oakland, Calif.

Mar. 23—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Apr. 23-26—American Foundrymen's Society, annual convention, Buffalo

Apr. 27—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Apr. 30-May 4—Material Handling Institute and American Material Handling Society, exposition and conference, International Amphitheatre, Chicago.

May 18—Malleable Founders' Society, eastern sectional meeting, Hotel Commodore, New York

May 23-24—American Society for Quality Control, annual convention, Hotel Cleveland, Cleveland

May 25—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

June 18-22—American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hotel, Atlantic City, N. J.

June 21-22—Malleable Founders' Society, annual meeting, the Homestead, Hot Springs, Va.

July 27—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Sept. 10-14—International Foundry Congress, Brussels, Belgium

Oct. 31-Nov. 2—Meehanite Casting Manufacturers, annual convention, Greenbrier Hotel, White Sulphur Springs, W. Va.

Oct. 31-Nov. 2—Foundry Equipment Manufacturers' Association, annual meeting, The Homestead, Hot Springs, Va.

Nov. 15-16 — National Foundry Association, annual meeting, Waldorf-Astoria Hotel, New York

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(*Concluded from page* 130)

tegrated mills as well as foundries to import pig iron. In this connection, the eastern railroads have established the following reduced freight rates of $7.50 per gross ton on shipments of import pig iron from Baltimore to Pittsburgh, $7.70 from Philadelphia, and $8.10 from Boston. The former rate from Baltimore was $8.75. Consumers are seeking a still lower rate, such as around $6.50 from Baltimore.

Higher scrap prices have brought increased tonnages into the market. However, oven foundry coke supply is tightening, resulting in advance of $1 per net ton by Pittsburgh suppliers.

Gray iron jobbing shops have voluntarily granted AFL employees 7½ cents an hour wage increase, despite contract reopening date of Apr. 30, 1951. Labor contract settlements last Apr. 30 involved increased insurance benefits. Early in September some jobbing shops raised castings prices 10 per cent, others advanced prices an average of 12.5 per cent Oct. 15. In addition to higher wage costs since early April, foundries have in recent months been paying $3 per ton more for pig iron, $1 to $2 per ton more for coke, about $20 per ton more for scrap, and 10 per cent more for refractories.

Blaw-Knox Co. is nearing completion of first phase of foundry modernization program in Pittsburgh covering improvements in these divisions: Lewis Foundry & Machine, Pittsburgh Rolls and Union Steel Castings. This phase of the program was originally projected over a year ago with a budgeted plan of $1.5 million. Actual expenditures have exceeded $2 million . . . . Doittau Producits Foundries, Corbeil, France, has been licensed by Pittsburgh Metals Purifying Co., Pittsburgh, on a royalty basis to produce thermotomic compounds and exothermic head compounds developed by Peter Soffel, president of the Pittsburgh concern. The licensing agreement includes formulas covering company's fluxes for all metals and alloys . . . . H. K. Porter Co. Inc., has sold its locomotive business—patterns, drawings, and spare parts business—to Davenport-Besler Corp., Davenport, Iowa, manufacturers of locomotives.

BRITISH GRAY IRON FOUNDRYMEN

Report on Trip to United States

REPORT of the British Productivity team on gray iron founding is an outstanding illustration of the beneficial effects of the free exchange of knowledge between British and American industry, which was promoted in the fall of 1948 on the initiative of Sir Stafford Cripps, British chancellor of the Exchequer, and Paul Hoffman, until recently Economic Co-Operation administrator in the United States.

The report was discussed at a private meeting of the Joint Iron Council (JIC) held in London, Sept. 20. This council comprises the Council of Iron Producers and the Council of Ironfounding Associations (CFA). It acts in the interests of some 2000 British iron foundries which, at the present rate, produce 3½ million tons of castings per year. On the occasion of the meeting only the management aspect of the report was discussed, the technical aspects being reserved for a meeting open to all members of the iron founding industry at Ashorne Hill Oct. 12-13.

Importance of the occasion was enhanced by the presence, at the JIC meeting, of Hermann P. Good, president of the Gray Iron Founders' Society, Cleveland, and superintendent of Textile Machine Works, Reading, Pa., and of R. L. Collier, then executive vice president of the Gray Iron Founders' Society, who were able to attend by arrangement with ECA. At the opening session of the JIC meeting, presided over by N. P. Newman, vice president of the council, supported by S. H. Russell, leader of the team which visited the United States in May 1950, Mr. Good addressed the members of the council. He conveyed the greetings of fellow foundrymen of the United States and complimented the compilers of the report on its impartiality and thoroughness.

Hermann P. Good addressing the Joint Iron Council in London

For the purpose of the discussion, the report was taken under a number of headings, each section being introduced by one or two members of the team.

The following sections were discussed:

Management, in regard to which mention was made of the high quality of management in the United States, of the interchange of methods, the activities of local cost groups, the fierceness of competition, the methods of training for management, and the recruitment, training and methods of payment of foundry foremen.

Workers and Environment, stressing the close contact in the United States between workers, trade unions and management; saving of time and study of motion; pay incentives; teamwork; punctuality and diligence, and the fear of unemployment. Mention was also made of the environment surrounding American workers, the availability of consumer goods and the effect of taxation on workers' efforts.

Training and Education, covering the American education system, vocational training, apprenticeship courses and the activities of technical associations.

Costing, in which the Gray Iron Founders' Society's basic cost system and its application in the foundry was reviewed.

Only a limited time was available for discussion of these various points, during which members stood up in rapid succession to offer comments which, in general, recognized that the lessons learned from the team's visit would greatly assist British foundries in increasing their output and efficiency, while making justified reservations in regard to fundamental differences existing between conditions in the two countries, and occasionally offering friendly criticism of certain aspects of American methods.

The findings and conclusions of the report of the Gray Ironfounding Productivity team were summarized as follows:

1. The first and most important point on which agreement must be reached by management and workers is that a greater production per head is not only desirable but essential, if Britain is to recover her economic status, and that in the iron founding industry greater productivity is essential owing to the shortage of manpower.

2. Government, management and workers must combine to rearrange

(*Concluded on page* 134)

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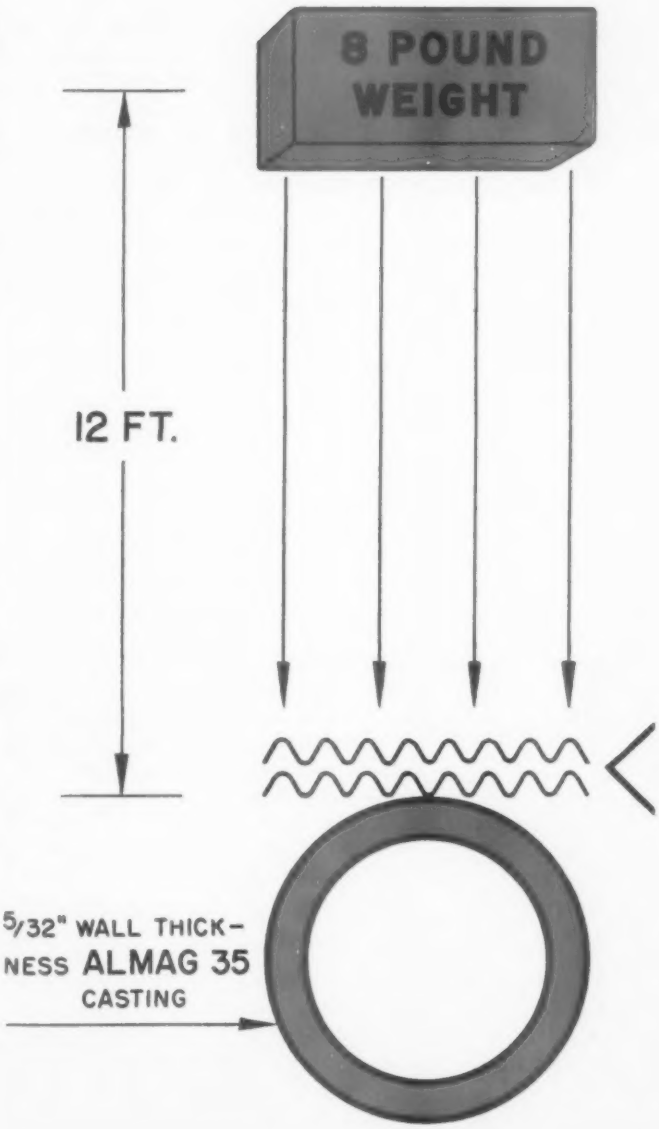

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(*Concluded from page* 132)

the real rewards for every one in Britain, so that the efficient may be well rewarded and the indolent may suffer some hardship.

3. Means must be found to engender a stronger feeling of goodwill and trust between management and workers.

4. Britain will require considerable acceleration in the equipment of secondary technical schools and a reorientation of the outlook of both teachers and of parents which, at present, magnifies the status of the secondary grammar school, and lowers the status of industry as compared with the professions or with "black coated" employment.

5. Those British iron foundries which have no costing system should emulate the Americans by installing, as a first step, a simple costing system.

6. The simplicity of the American wage structure should be adopted in Britain.

Immediate action is being taken by the Council of Ironfoundry Associations to pave the way of further implementing the findings of this report.

NFA Revamps Its Organization

National Foundry Association, Chicago, recognizing the need for more activities on the local level, has revamped its organization. Regional division within the group formerly was based on ten Federal Reserve districts. NFA now has set up 13 foundry areas in a move to provide better "grass roots" participation in its four-fold program: Management, labor relations, legislation and engineering. The 13 areas center in New Haven, Conn.; New York; Philadelphia; Syracuse, N. Y.; Pittsburgh; Cleveland; Columbus, O.; Cincinnati; Detroit; Indianapolis; Chicago; Milwaukee, and Peoria, Ill.

Election of chairman and co-chairman for each area is being conducted by mail, and not later than the first of the year each area will have set up a schedule of monthly meetings.

Plant Protection

"Principles of Plant Protection" recently has been published by the Department of Defense, Munitions Board, Washington. The publication discusses problems of plant protection, hazards to the industry, internal security, minimizing effects of enemy attack and planning for plant protection.

Insulation Increases Riser Efficiency

(*Continued from page* 75)

contain only the volume of feed metal required for volume contraction, or shrinkage, which the casting undergoes in cooling from the pouring temperature to the temperature at which the casting is solid. (Shrinkage or contraction of the solid casting is not affected by risering methods.) In this case, the result would be a sound casting having no visible riser after the casting has solidified.

On the other hand, for castings which solidify slowly it is necessary to have risers containing considerably more molten metal than is actually required for feeding. This additional metal is for heat to assure directional solidification, and to keep the metal in the riser in the molten condition for the required length of time. To illustrate this consider Fig. 4—an 8-in.-diameter solid bar 13 in. long. This casting would have a volume of 654 cu in. If we assume 7 per cent volume shrinkage for the metal in changing from a liquid to a solid, this casting would require 46 cu in. of molten metal from the riser during solidification.

Chills Speed Solidification

If this casting were made in a sand mold, solidification would proceed slowly, and the riser would have to remain molten considerably longer than if the casting were made using metal chills at the base and on the sides of the casting. Furthermore, the riser for a casting made in a sand mold with chills would have to be molten for a longer time than the riser for the same casting made in a metal mold. This is another way of saying that the slower the rate of solidification, the larger the riser required above the absolute minimum which would supply the required feed metal.

Actual experience for this type of casting showed us that an 8-in.-OD solid bronze bar cast in a sand mold without chills requires an 8-in.-ID insulated riser and this riser should be poured 6 in. high and covered with insulating material. This means a riser volume of 300 cu in. However, when metal chills are used to increase the rate of solidification, the casting can be fed with a 4½-in.-diam riser poured 7 in. high. This riser would contain 119 cu in. of molten metal. This is illustrated in Fig. 4.

Thus by using metal chills to increase the rate of solidification, an adequate volume of feed metal can be maintained in the liquid state in the 4½-in.-diam insulated riser long enough to feed the 8-in. solid bar. The casting is thus produced with a considerably higher yield of salable product than if an 8-in.-diam insulated riser were used, and the small riser is considerably easier to remove than the 8-in.-diam riser.

Small Section Castings—For castings having relatively small sections the correct dimensions for the insulated riser are based primarily on the actual volume of feed metal required by the casting or casting section to be fed by this riser. Castings having sections 1 to 3 in. thick solidify fairly quickly, and our experience has been that roughly twice the volume of metal which will be required should be poured into the riser. In other words, for a casting requiring 36 cu in. of feed metal, we would have a riser containing 72 cu in. of feed metal.

Fig. 5 is an example of this. The illustration shows a cored bushing of these dimensions: 8 in. ID, 11 in. OD, 13 in. width. The volume, then, would be 579 cu in. We know that this type of casting can be fed with one riser placed as shown, so we must determine the dimensions for this single riser. Previous experience with this bearing alloy indicated that the volume contraction was about 6 per cent. Therefore, we used a 3.5-in.-ID sleeve, and the metal was poured into the sleeve to a height of 7½ in. This provided 72 cu in. of molten metal to feed the casting, or roughly 12 per cent of the casting volume. Castings made in this manner have been uniformly sound.

The pouring height of metal in an insulated riser is primarily to have adequate volume of liquid metal. Normal risering practice indicates that the height to which the riser should be poured is a function of the diameter of the riser. However, since the metal in an insulated riser remains molten and does not freeze against the side, or insulating surface, the riser can be poured to a height dependent upon the volume of metal desired. For this reason a 2½-in.-diam riser may be poured to a height of 6 in. to get a metal volume of 29.5 cu in. After solidification this riser might be only 2 in. high, indicating that 19.6 cu in. went into the casting during solidification.

For massive castings, such as solid bars and chunky bearings, we have found that more riser metal must be used. In general, the section of the riser for these castings should be roughly that of the section to be

(*Continued on page* 137)

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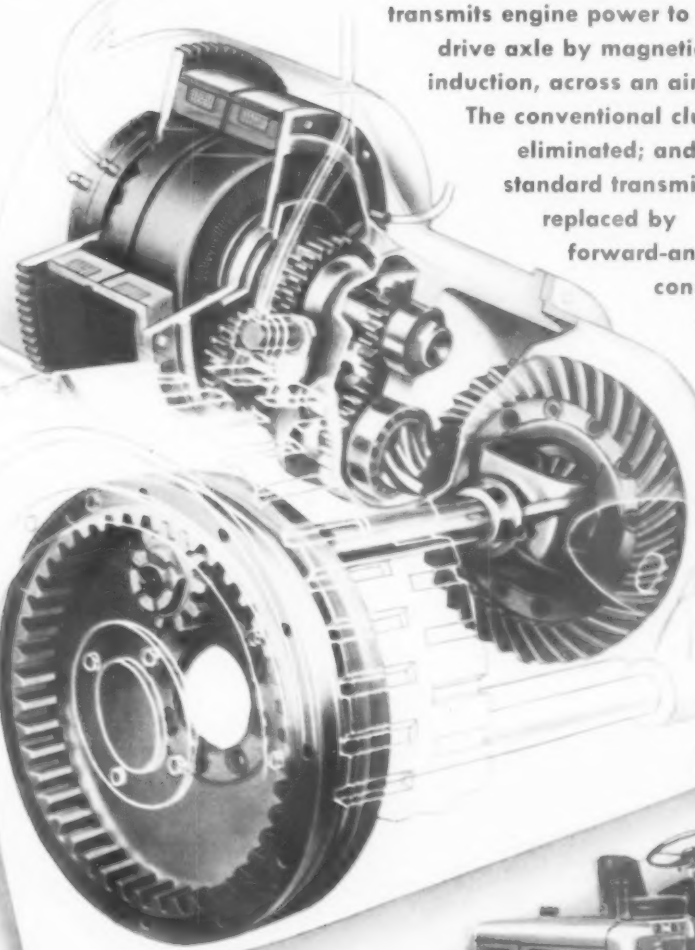

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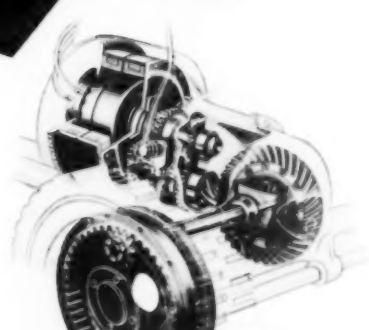

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(*Continued from page* 134)

fed, and for these castings the riser volume should be 35 per cent of the volume of the casting itself. This means that for the chunky castings we pour five times as much metal into the riser as would be required for adequate feeding. The yield in this case is still approximately 70 per cent.

For heavy-sectioned castings, the use of chills to increase the rate of heat extraction from the molten metal and thus increase the rate of solidification, has been found valuable. By increasing the rate of casting solidification, the size of the riser can be reduced considerably. In the case of the 8-in. solid bar illustrated in Fig. 4, the riser volume required was reduced approximately one-third by using chills to increase the rate of solidification.

Gating Practices—In general the gating practices followed when insulating risers are used are the same as in normal casting practice. Although gating into riser is strongly recommended in sand risering practice, we have found it unnecessary to gate into the insulated risers. However, it is important to gate the casting so as to prevent overheating the sand and thus forming a hot spot at the gate. Other than this, gating is the same as in normal practice.

We have found it useful to back feed these insulated risers in certain instances. The metal in the riser remains molten and in several cases the amount of feed required by the casting was considerably underestimated. In this case the risers were topped off several times with hot metal, and the resulting casting was uniformly sound on visual inspection and after machining. However, we do not recommend back feeding in this manner, better practice being to have an adequate riser so that no back feeding is required.

The use of insulated risers is further illustrated in Figs. 6 through 10. Fig. 6 is a sketch of a solid bar cast in the horizontal position. This method requires less molding skill and time than a bar molded vertically. However, the yield of a casting made with an open riser of this type is considerably less than that of the same casting molded vertically. Solid bars of this type have been made vertically with considerably increased yields over the one illustrated. This illustration is included to show a method for producing a solid bar molded horizontally. The use of chills on the base of the bar and on the end away from the riser increases the rate of heat extraction from the casting. This makes the casting solidify directionally toward the riser, and increases the rate of solidification. This assures a sound, dense casting.

Fig. 7 illustrates the use of one insulated riser to feed three camshaft

(*Concluded on page* 139)

GERMAN FOUNDRY ASSOCIATION

Holds Annual Meeting at Duesseldorf

ANNUAL meeting of German Foundrymen's Association was held at Duesseldorf. Sept. 22-23 in Robert Schumann hall. Members and guests were welcomed by Mayor J. Gockeln. Vice Chancellor Franz Bluecher, who also is federal administrator for the Marshall Plan, discussed the political economics of the foundry industry.

Importance of the foundry industry in Germany was pointed out since statistics showed that of the 7,140,000 metric tons of pig iron produced in 1949 in that country, 1,676,493 tons, or about 26 per cent, was used for manufacture of castings. In the nonferrous foundry field 59,375 tons of aluminum, magnesium, and other nonferrous alloy castings were produced. Employment in the foundry industry is about 150,000.

In the technical sessions Dr. Carl W. Pfannenschmidt, Cologne, reporting for the Gray Iron Technical Committee, pointed out that the use of soda in the form of "Walter Pakete" sometimes leads to inclusions of the material in the casting due to being carried along with the metal stream. Use of basic or neutral refractory linings in the desulphurizing ladles led to better sulphur removal. Placing the desulphurizing agent in the bottom of the ladle and pouring iron over it gave better sulphur removal than placing the material on the top of the bath. Best results were obtained by use of a dipping device for immersing the reagent in the bath since it resulted in stirring the bath.

Dipl. Ing. G. V. Schmidt, Bochum, outlined the various activities of the Technical Committee for Steel Castings. Those will deal with both technical and practical phases of steel casting production as well as research problems. Dr. Franz Roll, Duisburg, reporting for the Technical Committee for Malleable Castings, called attention to the new amplified standard for malleable "Normblatt DIN 1692." Also the group is arranging for publication of technical data sheets on malleable iron for the consumer covering such phases as physical properties, applications, welding, hardening and surface treatment. He also pointed out that studies will be made on the dynamic properties of malleable.

Dr. H. Timmerbeil, Hilden, stated that examination of radiant-type heat tubes containing 1.85 per cent Cr., 5.35 per cent Si. 0.54 per cent Mn, 0.57 per cent P, and 4 per cent Al had excellent stability at a temperature of 1000° C. Dipl. Ing. E. Weisner discussed "High Grade Special Bronzes," and pointed out that they included aluminum bronze, high-lead bronze, beryllium bronze, manganese bronze, silicon bronze, etc. He presented information on physical and other properties as well as handling in the foundry.

Other papers presented included "Development of Standardization in the Foundry Industry" by Dipl. Ing. A. Knickenberg, Neuss; "Nodular Cast Iron" by Prof. E. Piwowarsky; "Aim of Education for Apprentices and Engineers of the Foundry Industry" by Dr. E. Hugo, Duesseldorf, and a film "Foreign Foundry Machinery" presented by A. Gollmer, Duesseldorf.

Speakers' table at opening meeting of German foundry convention

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(*Concluded from page* 137)

bearings. The riser for these castings was 2.50 in. ID and was poured 5 in. high. Note the difference in level of the riser as compared with the original pouring height indicated by the down sprue and relief sprue in the background. This method enabled the foundry to make three bearings per mold, and the castings produced were uniformly sound both at the foundry and by visual inspection after machining. The riser-bob in the drag of the mold is to allow solidification against the uninsulated drag surface without freezing off the contact between the molten riser reservoir and the casting. We cannot emphasize too strongly the importance of maintaining a liquid system between the molten riser and the casting.

Fig. 8 illustrates a ring pot casting produced from 80-10-10 metal. Six 3.50-in.-diam insulated risers were used and the risers were poured to a height of 7½ in. After solidification was complete the risers were 4⅛ in. high. Net shipping weight of the casting was 948 lb and the gross weight 1130 lb. This gives a yield of 86 per cent. The indicated feed for this casting was approximately 5.3 per cent—a volume of metal representing 5.3 per cent of the casting volume was transferred from the risers into the casting during solidification.

Use Graphite Chills

An illustration of a heavy bearing is shown in Fig. 9. This bearing was 1½ in. ID, 12½ in. OD and 13¼ in. high. The metal was Navy "G" —88-8-4. The bar was made using eight graphite chills approximately 4 x 4 x 15 in., as shown at the right of the illustration. The casting was bottom gated, and the risers were filled by top pouring. The net casting weight was 528 lb, and the gates and risers weighed 94 lb after removal from the casting. This gave a yield of 84.9 per cent. Two 5½-in.-diam, 8-in.-high risers were used, and the risers were covered with exothermic hot topping compound. The risers were 5½ in. high after the casting had solidified. It might also be interesting to point out that the small core for this casting was made from a zircon sand mix for easy removal and to produce a good bore surface.

The use of insulating sleeves to produce a high shrinkage alloy is illustrated in Fig. 10. This manganese bronze valve stem was 15 in. in diam where the risers are located. This section was 3¼ in. deep, and was quite heavy in the center of the casting. For this casting four 3½-in.-diam risers were used. In this case the risers were "back fed" with hot furnace metal. The casting was sound under the risers and we feel sure that this casting was of excellent density, even though we do not have the precise figures for the indicated feed. The net casting weight was 279 lb, the gates and risers weighed 78 lb, giving a yield for this casting of 78.5 per cent. Exothermic riser compound was used on the insulated risers before and after backfeeding, as a safety measure.

Recommended Practice — The experience we have gained in using insulating riser sleeves can be conveniently summarized as follows:

1. Position riser to conform to the known laws of directional solidification. Remember that the effective feeding range of any individual riser is much less than one would normally believe.

2. Select dimensions for the riser or risers which will provide sufficient liquid metal to compensate for the volume contraction of the casting or casting section which the riser must feed.

3. Use metal chills to increase the rate of solidification when the ratio of surface area to volume is low, as for chunky castings.

4. Pour the casting only to within 1 in. of the top of the insulating sleeve. Then add exothermic hot topping compound or insulating powder to the top of the riser as quickly as possible. The topping compound can even be added while the metal is rising in the insulating sleeve.

5. Usually when placing the sleeve in the mold, leave the sleeve *inside* the moisture-proof covering. This will prevent any moisture pickup from the mold or the air.

6. Match the cope and drag sections accurately to prevent fin forming between cope and drag. Fins, if allowed to form, will dissipate enough heat to cause the riser to freeze across before the casting has been completely fed by the riser.

7. When using sleeves, have the riser insulation extend all the way to the casting. This is to prevent the riser from freezing off between the molten reservoir and the casting.

8. Use sleeves on copper, copper-base, or aluminum—alloy castings.

Other Applications—In addition to the specific uses illustrated here, insulating sleeves have given excellent results in the following applications:

1. To feed castings having a restriction in the diameter of the riser due to cope bars, cope strength, or contact area available on the casting for an adequate riser.

2. In producing pressure castings which had formerly given considerable trouble.

3. In eliminating sponginess found from time to time under the riser of bearing castings.

4. To increase the density of large bearing castings, thus eliminating microporosity and macroporosity often found in large bearings. We have shipped castings which were noticeably heavier due to better feeding.

5. To increase the yield of high-shrinkage alloys such as manganese bronze, aluminum bronze, high conductivity copper and silicon bronze.

6. To eliminate cracks and draws in the vicinity of inadequate risers as well as to eliminate other shrinkage defects.

Summary—The production of miscellaneous bronze castings at low cost is a continuous problem in a jobbing foundry. Since the most usual cause of defective work was known to be inadequate feeding, a program to utilize insulated risers was carried out during the past year at the Erie Bronze Co. The experience gained permits the following observations:

1. Bronze castings shrink as much as 7 per cent during solidification.

2. In normal risers, the freezing rate is approximately the same as the freezing rate in the casting. It is therefore necessary to use excessively large risers to assure dependably sound castings.

3. Riser insulation of gypsum-base material provides excellent insulative properties. In cavities of the same dimensions, metal remained molten six times as long in an insulated riser as in a normal sand cavity—27 minutes compared with 4½ minutes.

4. When required, metal chills should be utilized to assure rapid, controlled directional solidification to the molten reservoir contained in the insulated sleeve.

5. Use of sleeves does not present any unusual problems in handling, molding, or usage; the insulating material does not contaminate the molding sand.

6. Insulating riser sleeves provide the foundryman with a valuable production tool: castings can be produced dependably sound, yields are 75 per cent salable product or better, production can be increased, and delivery date can be met with assurance.

Topeka Foundry & Iron Works, 300 Jackson St., Topeka, Kans., suffered fire damage Oct. 23.

By EDWIN BREMER

Foundry DEVELOPMENTS

RECENT studies at Massachusetts Institute of Technology, according to Dr. James R. Killian Jr., show that the atoms in steel can rearrange themselves in the process which makes steel hard, even at extremely low temperatures of liquid helium—453° below zero, only 6° above absolute zero, the lowest theoretically possible temperature. That discovery, Dr. Killian noted, has refuted many ideas of low-temperature behavior which have assumed that the mobility of atoms decreases as temperature decreases, and all atomic movement ceases at absolute zero. However, it appears that steel hardening takes place more completely at low temperatures than any other, and at the temperature of liquid helium austenite can be transformed to nearly 100 per cent martensite.

* * *

FROM TIME to time the question arises as to the relative chilling powers of various nonmetallic molding materials, and it might be well to keep the following information in mind. It is taken from an investigation by Ruddle and Mincher some time ago, and the complete report is available in the September, 1949 issue of the *Journal* of the Institute of Metals (Great Britain). The relative chilling powers are given in the accompanying table. Bonded magnesite refers to material bonded with linseed oil; mold was baked at 100° C for 3 hr, and 12 hr at 220° C. Silicon carbide is bonded with 4 per cent bentonite and 1.3 per cent dextrine; mold was baked 12 hr at 220° C.

	Relative Chilling Power	
Mold Material	Aluminum-Casting Temperature	Copper-Casting Temperature
Bonded magnesite ...	2½	4
Bonded silicon carbide	1½	3⅝
Green synthetic sand.	1¼	2¾
Green Mansfield sand	1¼	2½
Dry synthetic sand..	1	2¾
Dry Mansfield sand..	1	2½
Plaster	⅞	1½

In their conclusions the authors state that grain size distribution of the material of a nonmetallic mold is an important factor which, by influencing the porosity and the extent of intergranular radiation, greatly affects the apparent thermal conductivity and chilling power, especially at high temperatures.

MORE RAPID degassing of molten metal with lower temperature drop is claimed for a recently developed process. Method employs a porous refractory insert plug in the bottom of the ladle which has a pressure chamber beneath with connections for introducing nitrogen or argon. Inert gas introduced through the porous plug disperses upward through the bath in fine bubbles which are said to provide rapid mechanical removal of hydrogen in a short period of time, and a subsequent decrease in temperature loss during the operation.

* * *

NEW DATA in a recently published report of the Society of Automotive Engineers are said to hold answers to low-temperature problems of engineers and metallurgists concerned with military and civilian ground vehicles, aircraft, welded marine vessels, ship plate, and chemical processing equipment. The report, "Low-temperature Properties of Ferrous Materials," evaluates effect of metallurgy, heat treatment and design on low-temperature behavior. As far as carbon is concerned, resistance to embrittlement at low temperature depends more on degree of dispersion than on quantity present. A fine spheroidal dispersion of iron oxide is least detrimental to low-temperature properties. Also disclosed are effects of manganese, silicon, sulphur, phosphorus, chromium, molybdenum, nickel, copper, vanadium, columbium, etc. In heat treatment higher impact properties are obtained from constant quenched structure. Copies of the treatise may be obtained from the society, 29 West 39th St., New York 18, for $4.

* * *

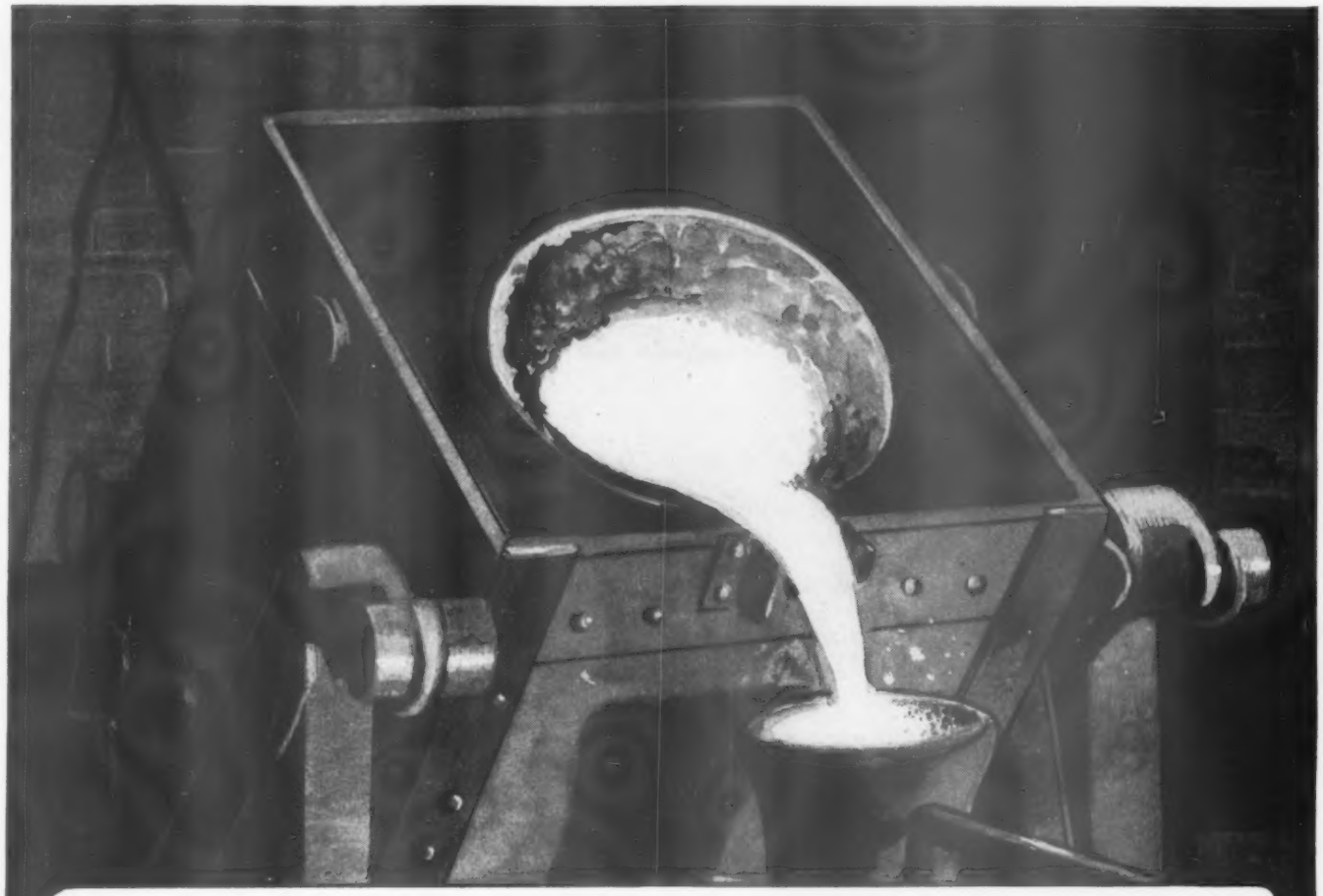
IN A REVIEW of the activities of various British research associations *Metallurgia* states that the British Iron and Steel Research Association in studies of hot-tearing and burning-on with relation to steel castings, reports that tearing temperature is generally of the order of 1400° C. Reduction of pouring temperature reduces tearing temperature and increases the stress required to cause it. Precise effects of various alloying elements is becoming apparent, and carbon above 0.2 per cent and most normal alloying elements added in small quantities increase susceptibility to tearing, but further additions of Cr, Mo, Ti and V reduce this tendency. In burning-on the study shows that metal penetration of the mold does not take place progressively, but rapidly on attainment of specific conditions, and then remains reasonably consistent. Pouring temperature, metal fluidity and mold permeability are major factors in governing this condition. It has been found that penetration occurred in all cases where temperature at the mold face immediately after pouring exceeded the solidus temperature with uncoated molds.

* * *

LARGE gray iron foundry in Pittsburgh occasionally melts nickel and ferrochromium in its electric furnace to make molten alloy additions to ladles of cupola iron. While the electric furnace normally is used for duplexing, it does double duty by providing high recovery of the alloys which might be lost in straight cupola melting as well as eliminating any temperature loss which might result from addition of cold alloys to the molten iron.

* * *

COGITATION on the various phases of compounding a suitable core sand mixture led one investigator to a procedure which provided results much beyond expectation. Standard method of mixing was to add cereal, moisture and core oil to the dry sand at one time, and mull for a period of four minutes to obtain desired physical properties in the core mix. However, at times additional cereal had to be added to provide the desired green strength which suggested that the bonding power of the cereal did not always develop properly. As a consequence the procedure was changed to see whether uniformity could be obtained. Now the method is to add dry cereal to the dry sand and mull, add the moisture and mull again, and then add the core oil with final mulling. Result was that the total cycle was cut in half—that is the proper green strength was developed in two minutes as compared to four.



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Gray Iron Founders' Society

HOLDS 22ND ANNUAL MEETING

A YEAR of progress in various activities of the Gray Iron Founders' Society was reported at the recent 22nd annual meeting of the organization. Held at the Netherland-Plaza, Cincinnati, Oct. 12-13, the meeting had a total attendance of about 300.

At the annual election of officers, E. L. Roth, Motor Castings Co., West Allis, Wis., was named president to succeed Hermann P. Good, Textile Machine Works, Reading, Pa. Other officers chosen are: Vice president, R. G. Schaefer, Schaefer-Goodnow Foundries Inc., Pittsburgh; secretary, J. S. Parrish Jr., Richmond Foundry & Mfg. Co., Richmond, Va.; treasurer, Henry J. Trenkamp, Ohio Foundry Co., Cleveland. New directors are: Walter O. Larson, W. O. Larson Foundry Co., Grafton, O.; George I. Gilson, J. E. Gilson Co., Port Washington, Wis.; and George E. Mellow, Liberty Foundry Co., St. Louis.

By WILLIAM G. GUDE
Managing Editor
THE FOUNDRY

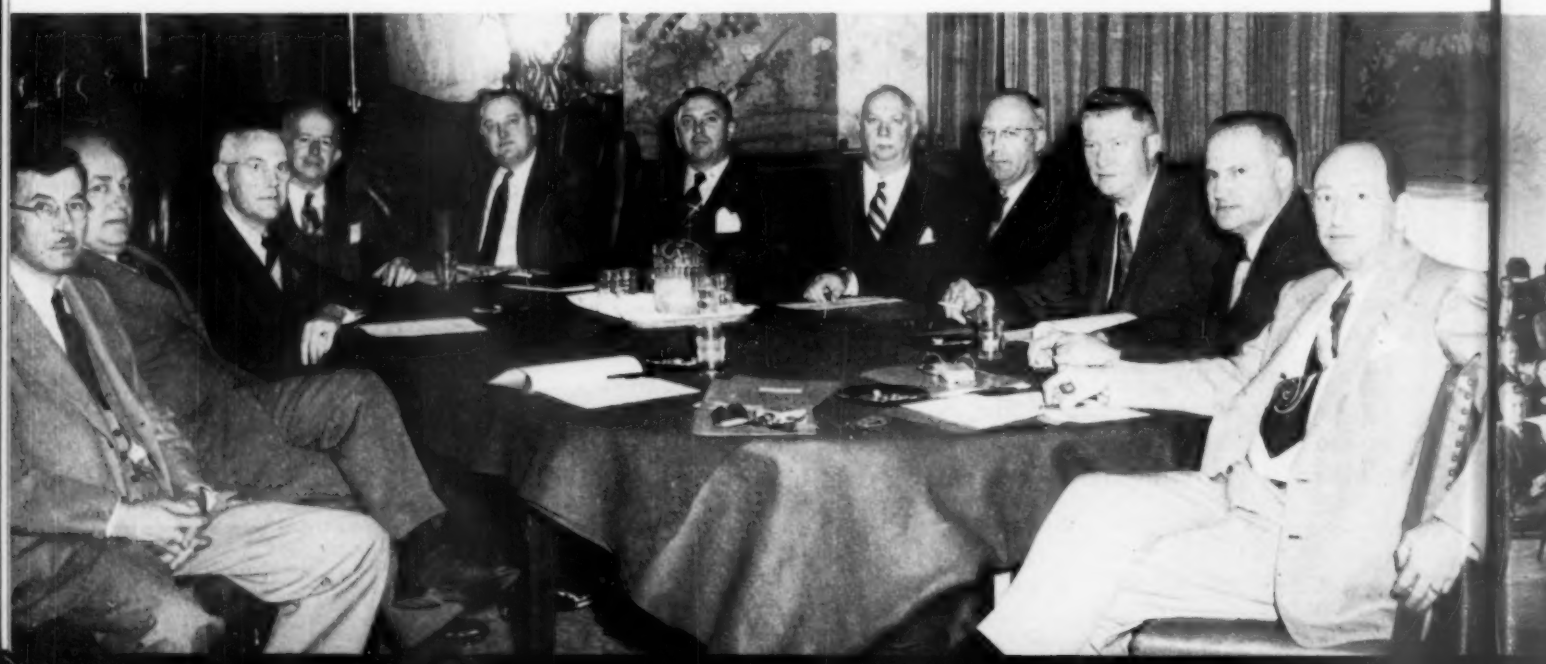
Oliver Smalley, president, Meehanite Metals Corp., New Rochelle, N. Y., was honored at the meeting by receiving the society's gold medal award. Mr. Smalley was cited for his pioneering work as first technical director of the society; for his "brilliant work to enhance the quality of gray iron castings, and his sound leadership in bringing foundry procedures to a higher state of excellence." The award was made by A. C. Denison, Fulton Foundry & Machine Co., Cleveland, a past president of the Gray Iron Founders' Society.

Other awards in the form of plaques for outstanding service to the society and the gray iron industry went to: Ray J. Redmond, Buckeye Foundry Co., Cincinnati; A. J. Rumely, LaPorte Foundry Co., LaPorte, Ind.; Sam D. Russell, Phoenix Iron Works, Oakland, Calif.; and Henry J. Trenkamp, Ohio Foundry Co., Cleveland.

First awards also were made in the society's new competition for redesign. This contest was instituted to determine the most significant and outstanding examples in which foundry engineers had redesigned a part or component for production as a casting in place of some other type of fabrication. Arthur W. Palm, sales representative, Olney Foundry Division, Link-Belt Co., Philadelphia, was awarded first prize. Second place went to R. A. Bogardus and J. D. James, chief of calculation department and superintendent, respectively, of the Cooper-Bessemer Corp., Grove City, Pa.

Opening session of the meeting was devoted to reports of officers and committee chairmen and was presided over by President Good. Mr. Good

Above—Oliver Smalley (right), president, Meehanite Metals Corp., receives the society's gold medal award from A. C. Denison, president, Fulton Foundry & Machine Co., Cleveland, and past president of GIFS
Below—New board of directors of the society includes, left to right: G. I. Gilson, E. B. Christensen, G. E. Mellow, E. N. Harrison, J. S. Parrish, W. O. Larson, H. J. Trenkamp, S. D. Russell, H. L. Edinger, R. G. Schaefer and H. P. Good



reported briefly on the meeting of the Joint Iron Council in London which he and Raymond L. Collier, executive vice president of the society, attended.

Mr. Collier's annual report to the Gray Iron Founders' Society, read in his absence, because of illness, by Herbert L. Edinger, Barnett Foundry & Machine Co., Irvington, N. J., the society's vice president, reviewed the activities of the third in a ten-year program formulated by the organization. This touched briefly on preparation of the new gray iron handbook, summary of wage rate-labor contracts, the code of ethics, bulletin on cupola dust suppression, the new safety booklet, activities in support of the Foundry Educational Foundation, and the summary of labor contracts. Mr. Collier also paid tribute to the late Watts W. Rose, for many years executive vice president of the society who died since the last annual meeting.

William M. Caldwell, assistant secretary of the society, reported on promotional and publicity activities intended to further a general knowledge of gray iron and an appreciation of its properties and usefulness.

Donald H. Workman, promotion manager, reporting on the society membership, stated that the Gray Iron Founders' Society now is the fourth largest manufacturers' trade association in the United States. Total membership is approximately 530. Speaking for the cost committee, Arthur E. Hageboeck, Frank Foundries Corp., Moline, Ill., stated that the new cost manual now in preparation will reflect changes in foundry operating practices which have been influenced by mechanization and increased machine molding. One additional cost group has been formed during the past year, making a total of 17.

About 300 foundries are participating in the society's compilation of monthly statistics concerning business conditions, it was reported by E. L. Roth for the statistical committee. Latest figures, those for August, indicate that jobbing foundries have a backlog of about two months' business. Compared with a year ago, when business activity in the gray iron industry was near the 1949 bottom, the upturn in castings output, number of employees and working hours has been sharp. On the debit side of the report, he pointed to the absence of improvement in the industry's injury frequency rate.

A large part of recent work of the technical committee has consisted of co-operation in preparation of the society's new handbook, it was reported by E. B. Sherwin, Chicago Hardware Foundry Co., North Chicago, Ill., committee chairman. Charles O. Burgess, technical director, stated that three chapters of the new handbook have been completed and others are under way. It is intended to inform designers and consumers of the industrial possibilities in using gray iron castings.

Mr. Burgess also reviewed briefly various technical developments of interest to the industry, including the study of solidification and gating of gray iron at the Naval Research Laboratory at Washington; nodular iron, the Croning process, and work on use of the basic lining in cupolas.

Tangible progress of the Foundry Educational Foundation in recent years was detailed by R. J. Redmond, Buckeye Foundry Co., Cincinnati. The FEF, of which the Gray Iron Founders' Society is a founding member, apparently has reached the limit of its service capacity with the 12 engineering schools with which it is co-operating, but influence of the foundation will become increasingly felt in the future, Mr. Redmond said.

E. L. ROTH
President, Gray Iron Founders' Society

During the past three years, 468 engineering students graduated from FEF schools have been placed in the foundry industry, while 497 students have obtained summer employment in foundries.

A report on activities of advisory committees to the Munitions Board was made by Walter L. Seelbach, Superior Foundry Inc., Cleveland. Mr. Seelbach, chairman of the gray iron subcommittee of the Foundry Industry Advisory Committee, urged foundries to co-operate in the survey being made of gray iron foundries by the Munitions Board to determine their potential capacity and materials and manpower requirements.

Other committee reports included that of the terms and conditions of sale committee, presented by J. W. Perry Jr., Grede Foundries Inc., Milwaukee; and the advertising committee report, given by E. H. Thompson, the H. P. Deuscher Co., Hamilton, O.

A symposium on foundry cost accounting had C. R. Culling, president,

(*Continued on page* 146)

Luncheon session concluding the society's annual meeting in Cincinnati

AT ELECTRO-ALLOYS, IT'S . . .

QUALITY PLUS

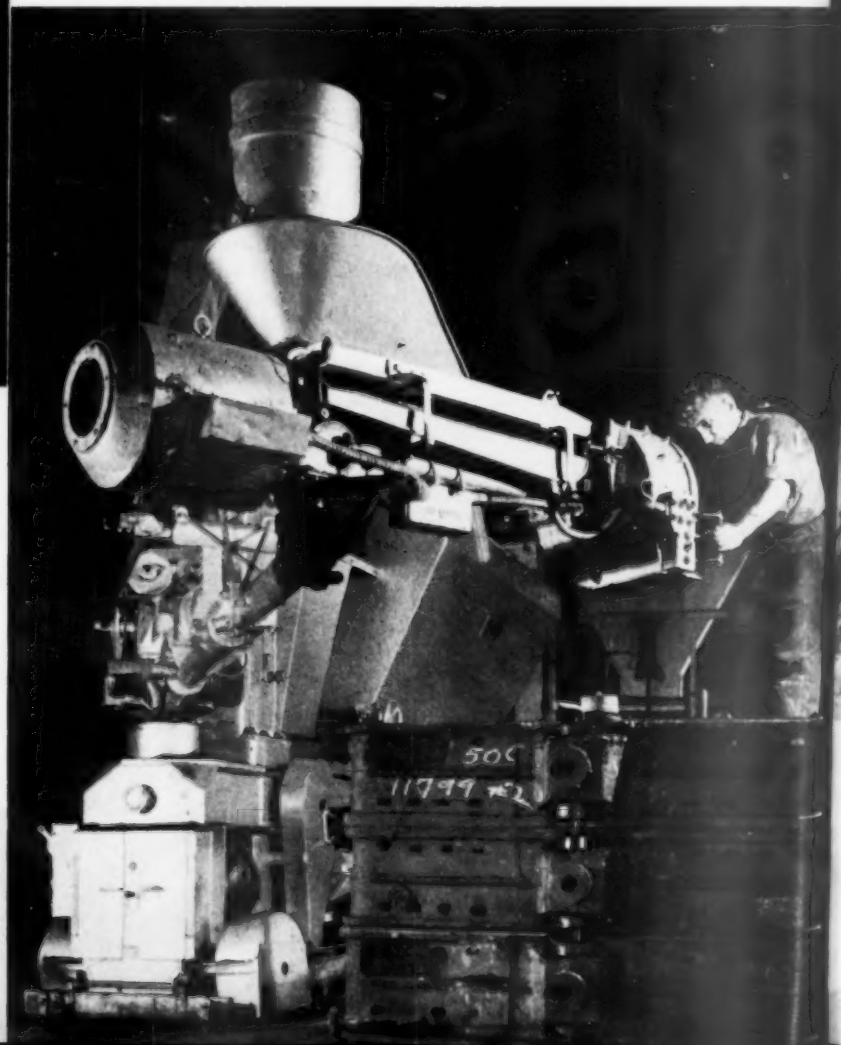
Electro-Alloys' new foundry at Elyria, Ohio was specifically designed to produce high quality alloyed steel castings. This foundry makes a wide range of special property castings from a variety of patterns. It's a jobbing operation but high production and economy are very important. That's why they chose a Motive Sandslinger to ram all of their large molds and a Model "80" Speedmullor to completely mull all of their molding sand.

The Motive Sandslinger rams molds for castings weighing up to 14,000 pounds, and produces approximately 40% of this foundry's monthly output. Essential quality advantages and appreciable reduction in molding costs have been accomplished. The Slinger has considerably extended the range of castings that may be profitably produced.

The foundry's entire requirement of molding sand—mulled to exact physical specifications—is produced in Electro-Alloys'

MOTIVE SANDSLINGER

FOR TRUE TO PATTERN MOLDS!

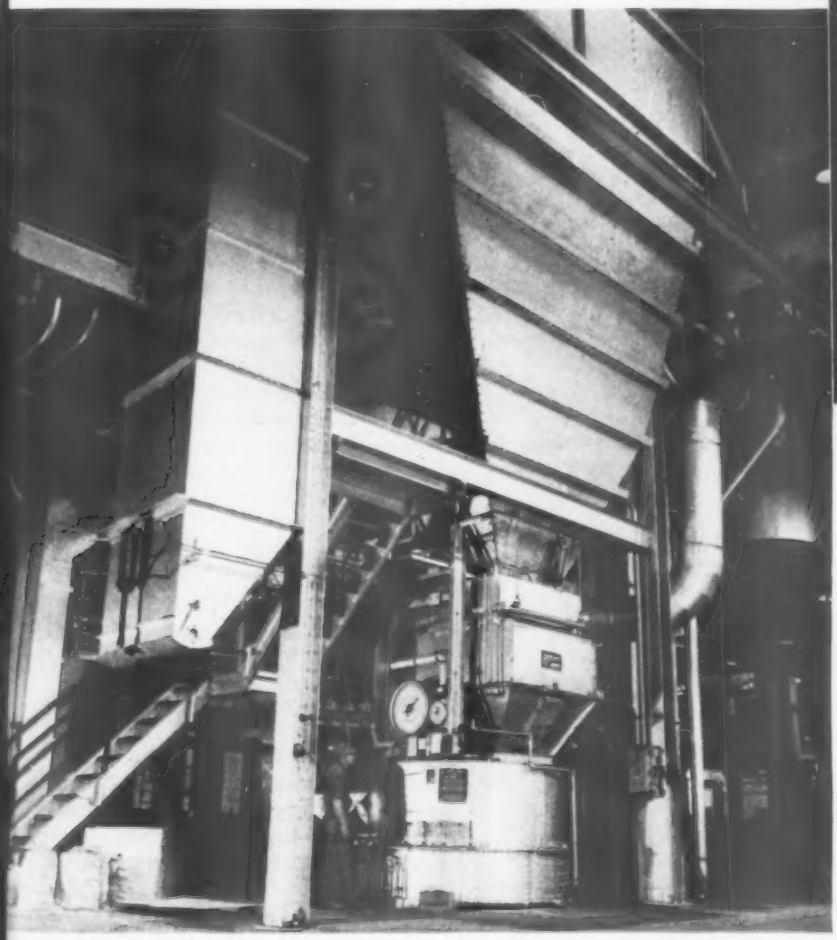


The Motive Sandslinger rams all of Electro-Alloys' larger molds . . . molds up to 9' x 15'. Truer to pattern castings, higher production and improved casting quality are some of the results attained with the Slinger.

PRODUCTION

Model "80" Speedmullor. The rapidity of mulling of the Speedmullor—4½ times as rapid as any other mixer—is fully utilized by a completely mechanized batch loading and sand distribution system. Here, too, speed and high production have been attained, and quality has been greatly improved.

The complete story of Electro-Alloys' foundry operations will be featured in a coming issue of Better Methods. A request from you will put your name on the Better Methods mailing list to receive this publication monthly.



The foundry's entire daily requirement of molding sand is mulled to maximum physical properties in the Model "80" Speedmullor. Batches are measured into the Speedmullor by batch hopper from an overhead 120-ton storage hopper. Mulled sand is discharged onto an under-floor belt which carries it to the foundry distribution system. This system supplies sand to the Motive Sandslinger and fifteen molding machine hoppers.

SPEEDMULLOR

FOR HIGHEST QUALITY SAND!

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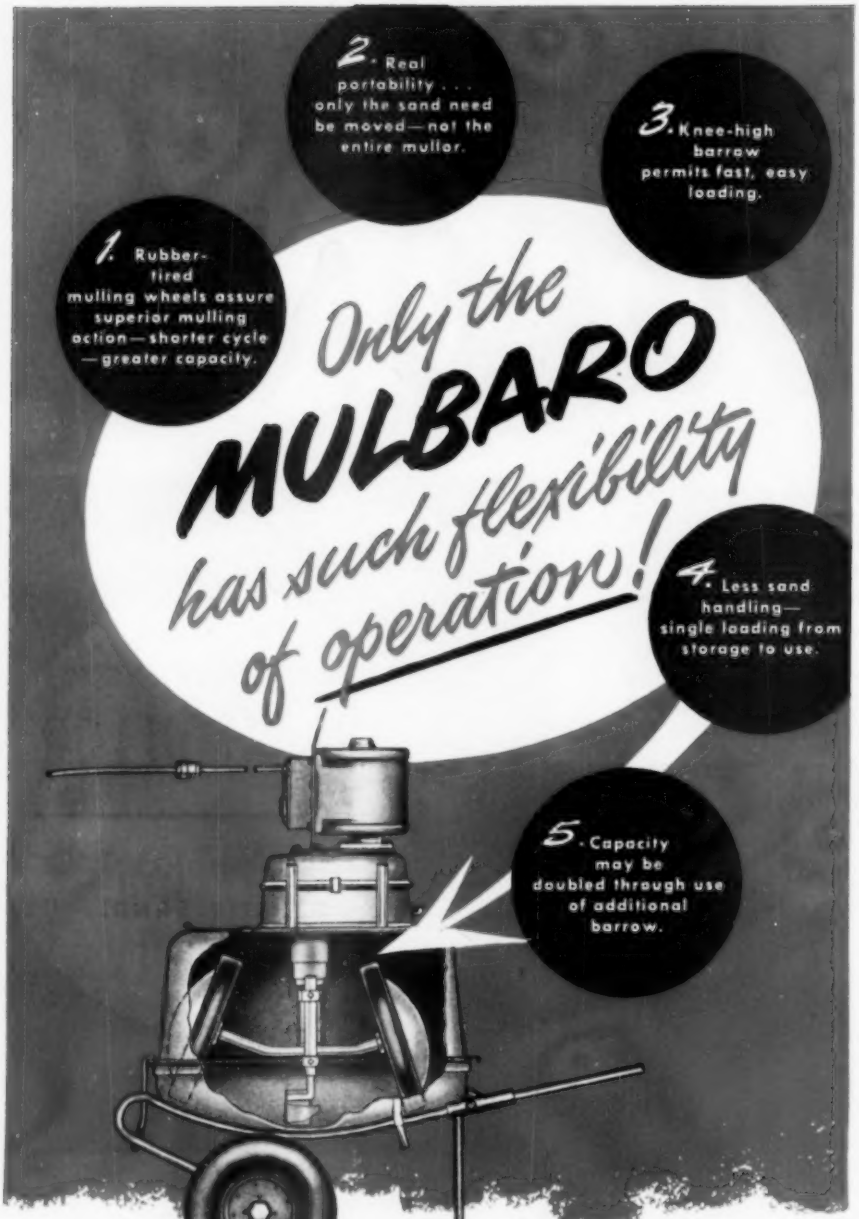
B&P

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA


2. Real portability . . . only the sand need be moved—not the entire mullor.
3. Knee-high barrow permits fast, easy loading.
1. Rubber-tired mulling wheels assure superior mulling action—shorter cycle—greater capacity.
Only the MULBARO has such flexibility of operation!
4. Less sand handling—single loading from storage to use.
5. Capacity may be doubled through use of additional barrow.

If you want *thorough* mulling, *minimum* sand handling and *real* portability at *lowest* initial and operating cost . . . then the Mulbaro is the answer! The Mulbaro is used for many different applications in large or small foundries—for core, facing and molding sand or for special batches of ladle lining or cupola patching material. Several barrows may be used alternately, thus providing the capacity of two or more mullors for slightly more than the cost of one. Write today for complete information on the Mulbaro.

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FEMA

(*Continued from page* 143)

Carondelet Foundry Co., St. Louis, as moderator. John L. Carter, cost consultant of the society, was the first of three speakers, discussing "Advanced Cost Estimating." Mr. Carter declared that greater progress had been made in the gray iron foundry industry in mechanical developments connected with production than in the formulation and use of improved cost methods. He explained how different costing methods are applied to different types of foundries, and discussed application of proper procedure to the cleaning and coreroom departments. Basing coremaking costs on the weight of materials used plus charges for direct labor, baking and handling of cores, etc., is the proper method, he said. Older methods involved errors of as much as 1 cent per pound or more. Mr. Carter pointed out that cost control is enhanced by mechanization and wage incentives in that closer check of records is maintained.

In discussing incentive plans, C. E. Westover, Westover Engineers, Milwaukee, pointed out that such plans will not work by themselves. They require proper adaptation and preparation. Mr. Westover presented charts showing the effects of incentive plans on productivity in foundry departments.

Set Up Budgets

Discussing cost control, Dickey Dyer, Dyer Engineers, Cleveland, explained the application of standards data in determining payroll costs. He recommended the setting up of budgets on operating department payrolls, servicing department payrolls, variable expenses and fixed expenses for comparison with actual performance. This permits comparison of actual costs for each item against the budget and provides an opportunity to discover excessive costs and institute improvements. While the procedure does not constitute control in itself, it points to the instances where controls can be applied.

Speaking on "Industrial Mobilization" Col. Earl D. Payne, Munitions Board, Washington, told the convention that preparation of an industrial mobilization program for the gray iron foundry industry would start shortly. This will give the Munitions Board a picture of the industry's casting capacity as well as its needs in the form of materials and manpower. Colonel Payne also gave a general resume of the functions and operations of the Munitions Board. A more detailed explanation of this subject by Colonel Payne was presented in THE FOUNDRY, November.

A convincing discussion of the val-

ue of safety work in industry was presented by G. D. Cross, safety director, Firestone Tire & Rubber Co., Akron, O. Anybody who cannot afford safety programs cannot afford to be in business, he declared. Many plants, he pointed out, do not realize the value of safety in increasing their production. More important than the losses which safe practices prevent is the fact that they improve production efficiency.

Mr. Cross listed these benefits from an adequate safety program: Reduced costs; improved production; better employee relations and improved morale; better supervision; improved loyalty on the part of employees; improved housekeeping and equipment, and more efficient methods. Experience has demonstrated, he concluded, that safety programs are worth several times their cost.

Operate Basic Lined Cupola

Operation of a basic-lined cupola was described by Dr. James T. MacKenzie, American Cast Iron Pipe Co., Birmingham. This company has conducted extensive experiments with a small cupola lined with magnesite brick and employing calcium carbide as a flux. The company is now starting commercial production with a cupola of this type lined to 42 in. The important benefit of sulphur and phosphorus removal from the metal, together with high temperature and increased carbon pick up, which result from use of the basic-lined cupola, have important significance in the production of nodular graphite iron, Dr. MacKenzie pointed out. Despite the higher cost of the basic lining, the equipment has other advantages which appear to make it desirable economically.

At the first of two luncheon meetings, William J. Grede, president, Grede Foundries Inc., Milwaukee, gave an inspirational talk on "Selling the American Tradition." He explained the philosophy which has contributed to American industrial development and our way of life, and made a strong plea for its retention and strengthening. Josh Lee, former U. S. senator from Oklahoma, spoke at the concluding luncheon on recent political trends as they affect the American economy.

A buffet supper Thursday evening was followed by an entertainment program arranged by a local committee under the chairmanship of William Beiser, Reliance Foundry Co., Cincinnati. High light of the affair was a surprise program presented by a chorus of local members of the society, directed by Ray J. Redmond, Buckeye Foundry Co., Cincinnati.

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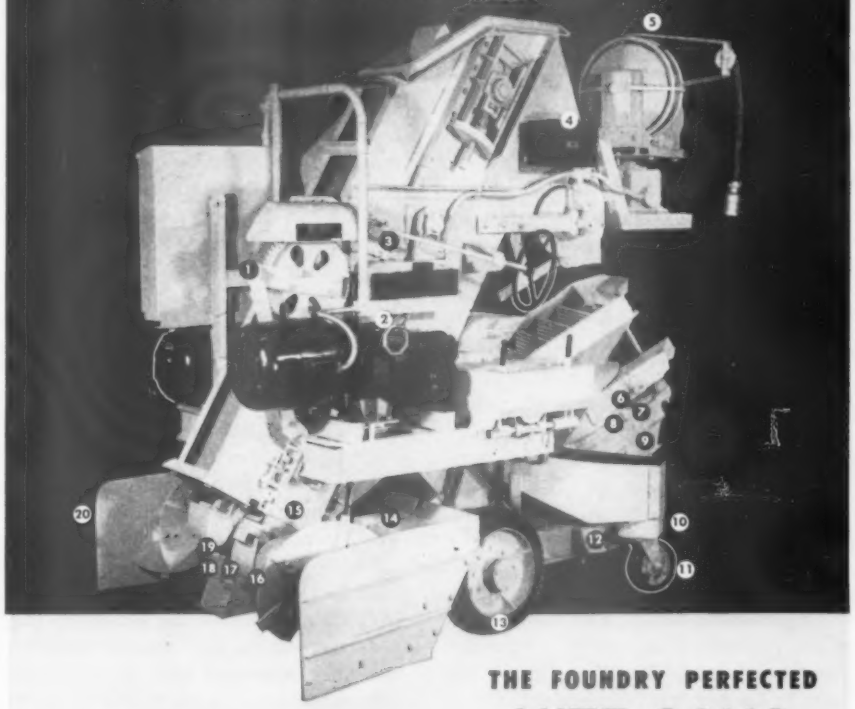
HOW TO RECONDITION SAND ON THE FLOOR AFTER SHAKEOUT!

Get up to 50 tons per hour of completely conditioned sand with the new, improved Nite-Gang! It self propels, self loads, blends, magnetically separates, breaks lumps, thoroughly screens, double aerates and windrows or piles. The Nite-Gang increases molders' productivity and lowers molding costs!



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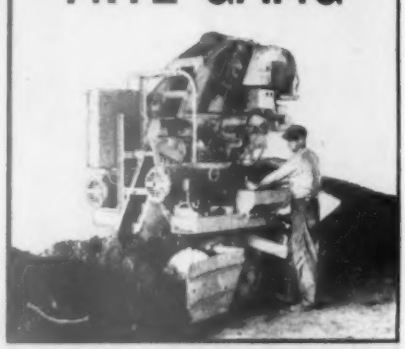

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NEW ENGLAND REGIONAL CONFERENCE

Offers Interesting Program

By WILLIAM G. GUDE
Managing Editor
THE FOUNDRY

ONE of the most successful of the New England Regional Foundry Conferences was the tenth meeting held at Massachusetts Institute of Technology, Oct. 27-28. This annual gathering, sponsored by the New England Foundrymen's Association in co-operation with 11 other foundry and technical societies and MIT, attracted well over 300 foundrymen to Cambridge, Mass.

The conference was arranged by a committee headed by Frederick M. Fitzgerald, Draper Corp., Hopedale, Mass., with Thomas I. Curtin, Waltham Foundry Co., Waltham, Mass., serving as vice chairman and Stanley E. Tims, Saco-Lowell Shops, Biddeford, Me., program chairman. Registration was handled by a committee from local representatives of foundry supply companies of which C. A. Wyatt, Debevoise-Anderson Co. Inc., Boston, was chairman and Herbert H. Klein, Klein-Farris Co. Inc., Boston, was treasurer.

Mr. Fitzgerald presided at the conference opening at which the participants were welcomed in a brief address by Thomas K. Sherwood, Dean of Engineering, MIT. The first of six talks presented at three technical sessions covered "Foundry Costs" by John L. Carter, cost consultant, Gray Iron Founders' Society. Earl Bradley, Builders Iron Foundry, Providence, R. I., was session chairman.

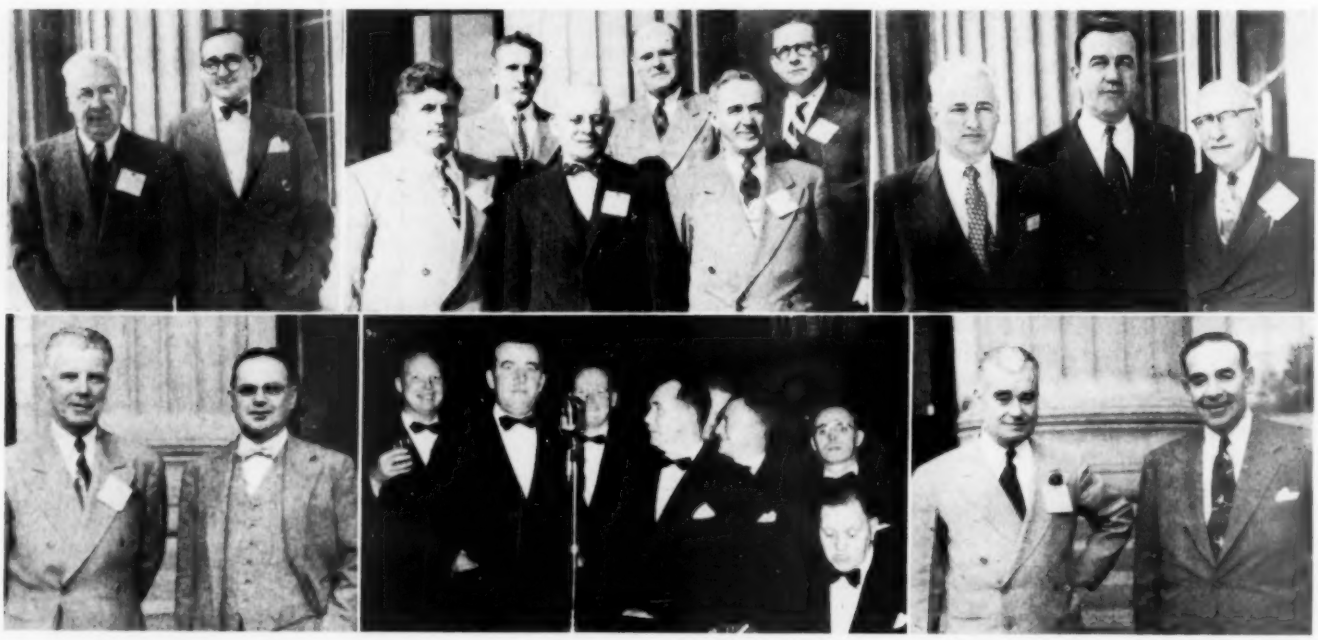
Describing sound costing practice as one of the most essential factors in efficient foundry operations, Mr. Carter pointed out that in the past the most profitable foundries have been those employing the best cost system. He urged foundries to base their quotations on actual job estimates, not on their competitors' prices. Mr. Carter detailed methods of making job cost estimates by both jobbing foundries and production shops, and listed these essential factors in effective cost control: A cost-conscious management; reports which will give management information it needs for cost control purposes; compilation of such reports monthly, their availability promptly after the end of each month and immediate study of items which are out of line; conferences with responsible department heads to discuss results.

Indirect labor costs should be watched carefully because usually they do not receive the attention they deserve. Time and motion study is the only accurate way to determine fair production rates, and a scientific wage incentive system is the best method of attaining maximum production, Mr. Carter said. He also recommended a comparison of individual cost items with those of other foundries, through organization of local cost groups.

An effective demonstration of how motion study and simple rearrangements of facilities can increase production in various foundry operations, and at the same time reduce worker effort, was given by Norman J. Henke, manufacturing superintendent, Central Foundry Division, General Motors Corp. Two examples of how motion study by this company indicated better methods included a core cleaning and inspection operation and the making of simple cores. Both operations were performed by the old and new methods to show the time saved and fatigue eliminated by the latter. Other instances of better methods applications were described by a motion picture. L. M. Sherwin, Brown & Sharpe Mfg. Co., Providence, R. I., was session chairman.

Foundrymen must become sand-conscious if they are to avoid the many problems incident to careless sand practice, it was stated at the second technical session by Charles B. Schureman, Baroid Sales Division,

(*Continued on page* 150)



Some of the conference committee members and participants in the tenth annual regional gathering at Cambridge, Mass. Conference photos by C. A. Wyatt, Debevoise-Anderson Co., Boston

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The SLY name on your Tumbling Mills has been the Standard of Sturdiness for many years.

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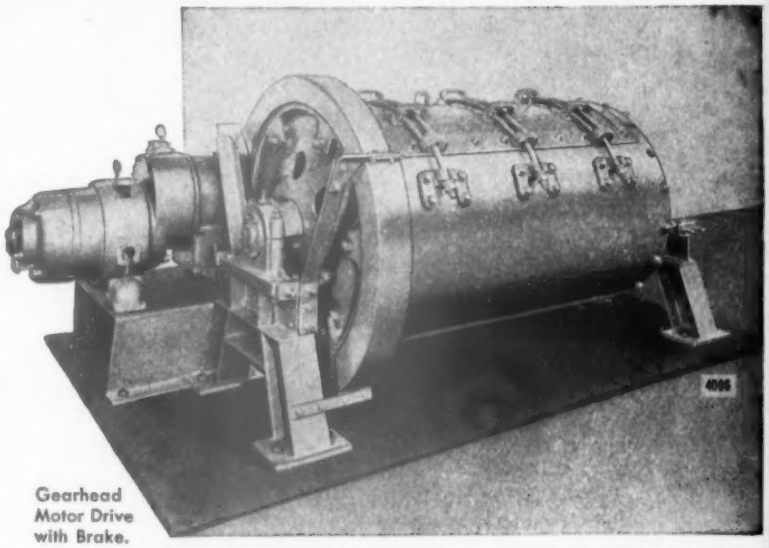
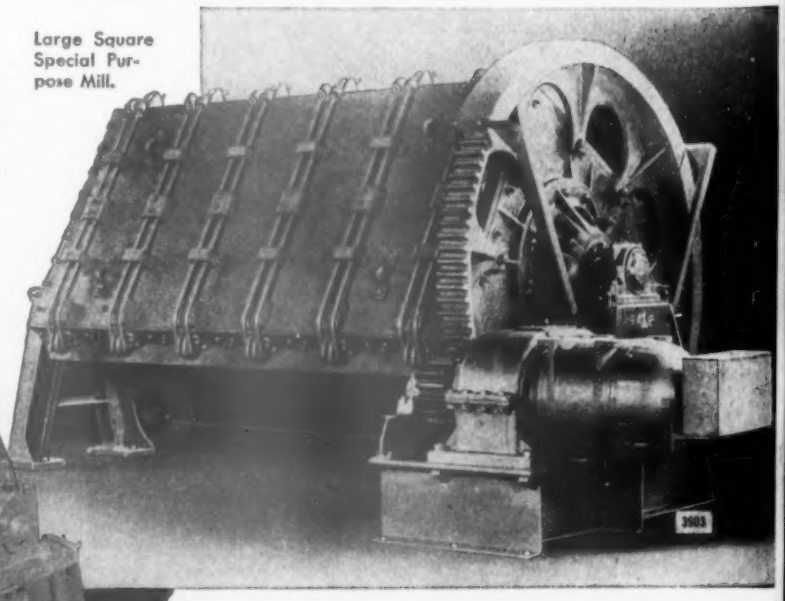
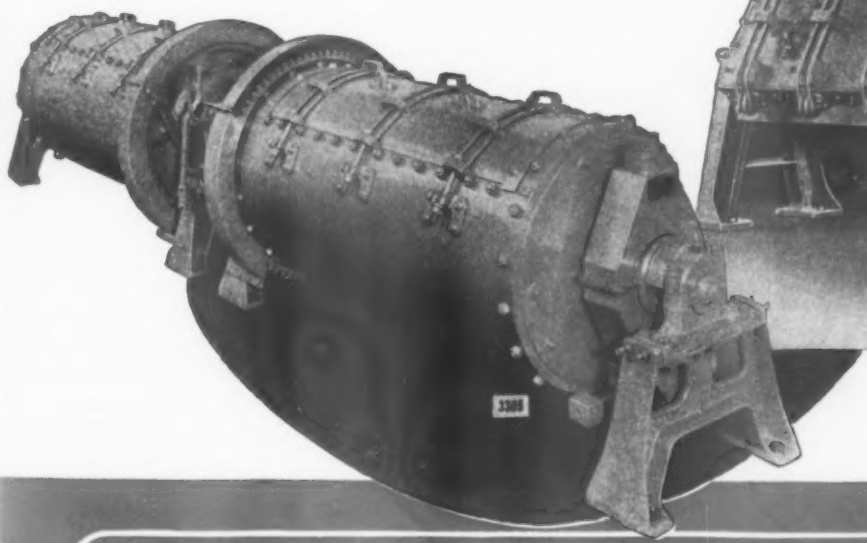


Gearhead Motor Drive with Brake.



Large Square Special Purpose Mill.



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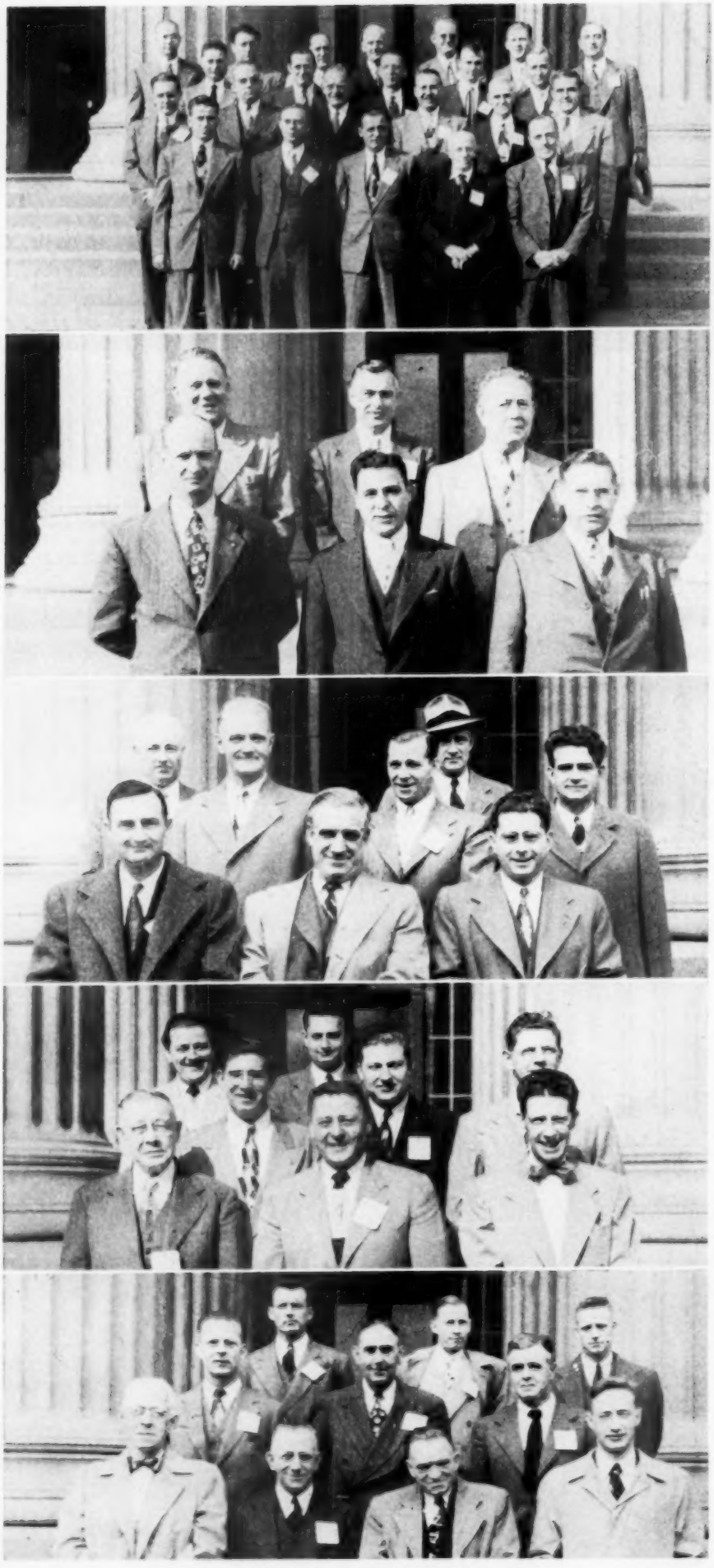


A few of the more than 300 visitors to the New England Regional Foundry Conference

(*Continued from page* 148)

National Lead Co., Chicago. Fred Clark, Whitehead Bros. Co., presided. Mr. Schureman offered numerous practical recommendations for overcoming common sand problems. Base sand selected for a synthetic molding sand mixture should have the best grain size and distribution for the purposes required, but it should be remembered that build-up by core sand at the shakeout eventually can alter the grain size. Use of the wrong size seacoal also can cause trouble.

While batch type mixing is preferred, Mr. Schureman said, difficulties will be encountered unless a capable man is in charge of the sand mill and the containers used for making additions are accurate. Ingredients added to a sand mixture should be weighed; weight of a given volume of a material taken from the top of a bag or bin is different than that at the bottom. Moisture control of sand is important not only when sand is being mixed but also after it leaves the mixer.

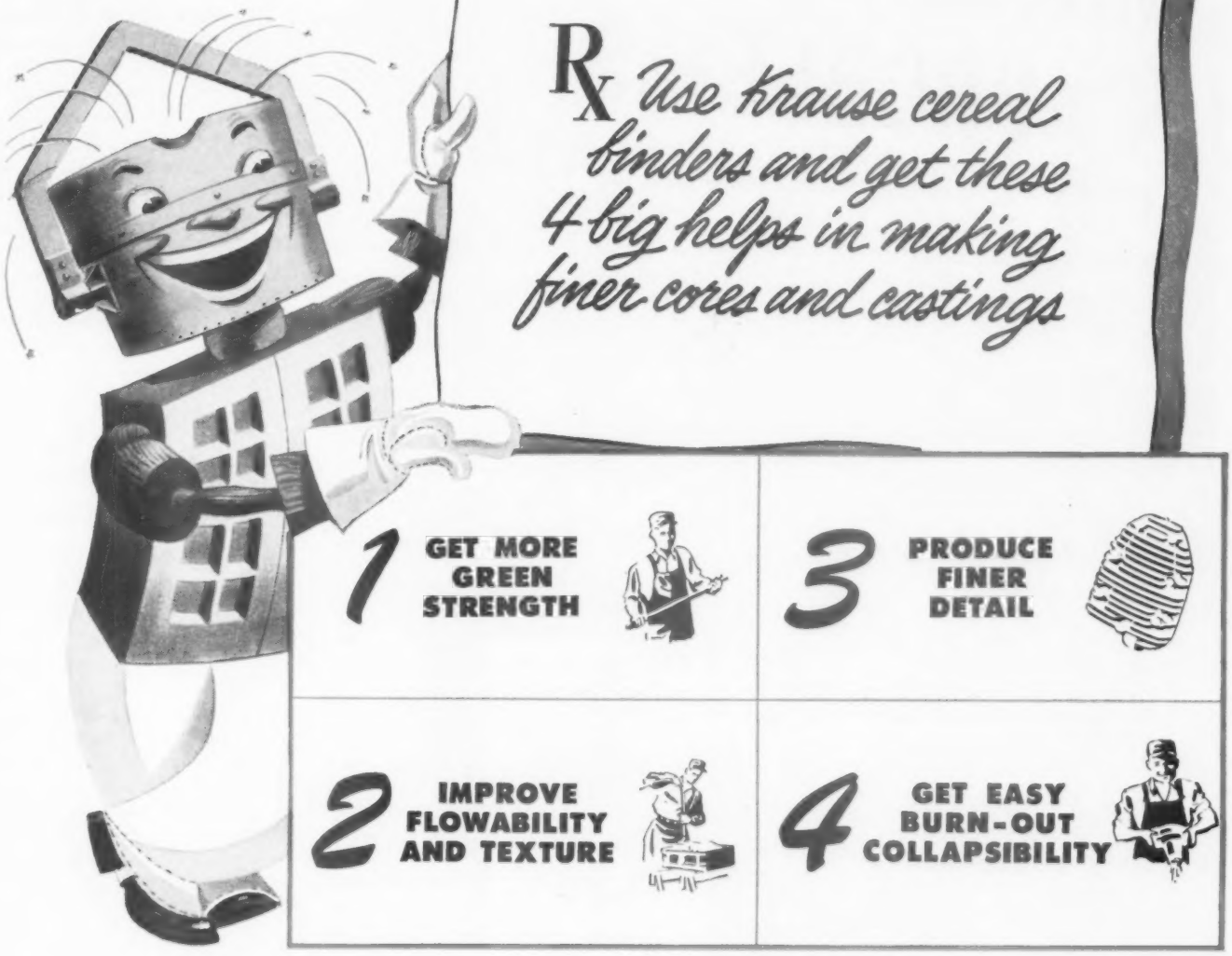
Experiments in production of castings by the Croning process were described in an illustrated talk by Bernard M. Ames, senior metallurgist, New York Naval Shipyard. A detailed discussion of this subject by Mr. Ames was presented in THE FOUNDRY for August. R. F. Meader, Whitin Machine Works, Whitinsville, Mass., was session chairman.

At the concluding technical session, presided over by Joseph B. Stazinski, General Electric Co., Lynn, Mass., Tom Barlow, Eastern Clay Products Inc., Jackson, O., discussed cupola practice with particular reference to linings. He pointed out that the operator should recognize that his cupola diameter is changing with use, yet operating practice usually is held constant and predicated on the diameter at the start of the day's run. This wear on the lining is fastest in early stages of the run. Value of contour patching was emphasized with the recommendation that the patch be made to result in as close as possible to the final diameter desired.

Final talk was given by Ralph L. Lee, General Motors Corp., Detroit. In his customarily capable fashion Mr. Lee emphasized the importance of humanics in industry. He pointed out that the human element can rank in importance with technical skill in determining the success of an in-

(*Concluded on page* 152)

Prescription for Core Troubles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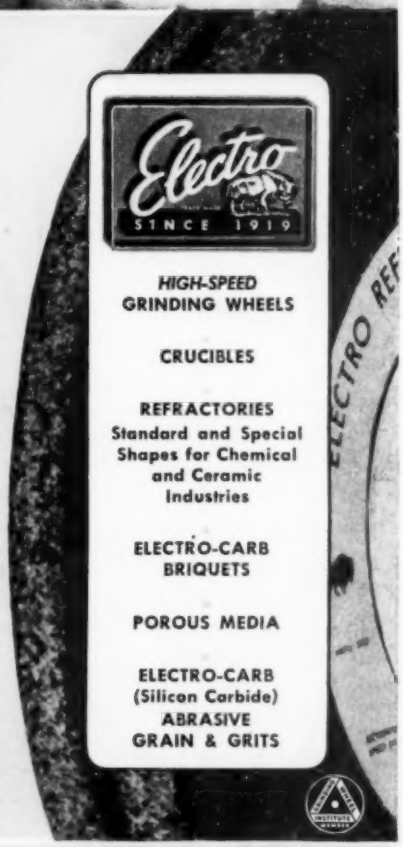

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(*Concluded from page* 150)

dividual foundry's operation.

The annual conference dinner Friday evening had Prof. Howard Taylor, MIT, as chairman and Conference Chairman Fitzgerald as toastmaster. An interesting and entertaining talk on his experiences as a football referee was given by Paul Swaffield, advertising director, Hood Rubber Co.

The Foundrymen's Smoker concluding the conference measured up to standards of this social event in the past. Held at the Parker House Roof Saturday evening, it was sponsored by local representatives of the foundry supply companies. The committee in charge of arrangements was headed by Ray Hunter, chairman, Harry Impey, treasurer, and Frank Kumer. Entertainment and distribution of prizes featured the evening's program.

Permanent Mold Casting Aluminum Engine Blocks

(*Continued from page* 85)

thermal conductivity to keep the mold at the proper temperature at all times during the casting cycle.

As a result of this procedure it was learned that excessive thicknesses of the metal could be reduced without impairing the casting, to provide a greater uniformity of metal sections, and savings in metal as well. The minor design changes were agreed upon, and production was started with development of the wood pattern for the permanent mold.

In making the pattern, care was taken to allow for shrinkage of the iron from which the mold was cast. The company makes substantially all of its molds from a high grade gray iron, cast to very close limits, in preference to machining the mold from a solid because this method facilitates holding the outside contour of the mold, in relation to the cavity shape, to uniform thickness. Allowance was also made to permit finish on all joints and cores that can be machined readily (Fig. 3 and Fig. 4).

Provision for proper gating was also an important consideration in making the pattern. For permanent mold casting, it is imperative that the back or gate end of the mold be made sufficiently large or thick to maintain proper metal temperature. This is the hottest part of the mold since all the metal received by the mold passes over this area; therefore the heat must be dissipated faster

(*Concluded on page* 154)

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(*Concluded from page* 152)

than in other parts of the mold. Care also is taken to avoid internal porosity in the mold which would interfere with uniform thermal conductivity of the mold while pouring. Thermal conductivity is the primary means by which heat is dissipated from the casting at the proper rate to insure the desired temperature throughout the casting cycle.

Upon completion of the mold casting, the iron was annealed to specification, which is at no time softer than 240 brinell nor harder than 265 brinell, to avoid excessive machining costs.

After normalizing, the molds were taken to the die shop for inspection and checking of critical dimensions. The next step was to machine the joint of the cavity, and then the cavity itself, and apply all integral cores to the mold. (These are cores that do not need to be extracted). Then the cores of the exhaust and water jacket were machined separately (Fig. 1). "A" is exhaust core; "B" is water chamber core.

These cores were so constructed that "A" could be withdrawn approximately ½-in., after which shoulder bolts contact core "B", and it too would be withdrawn as one unit. The cylinder bore core was also withdrawn approximately ½-in. to again progressively remove the core cluster.

In making permanent molds, the company has found it expedient to use a rack and gear combination for withdrawing cores. This method has proved most successful because it withdraws cores on a position straight line without binding. However, a toggle lever can be used to pull small cores that will be withdrawn only a short distance.

Clamping the mold is highly important. For this specific casting the opening and closing device acts as a clamp, and one other clamp is used to hold the mold together during pouring. It is not necessary to put a great strain on the mold cavity by clamping, since the casting is poured by gravity alone. Provision also was made for proper venting to permit escape of air while the cavity is being filled.

The mold was next completely assembled and mounted on a mock-up pouring machine. At this time the mold mechanisms were operated to check and adjust tolerances to allow free movement of the cores at normal operating temperature.

The machine used for permanent mold casting is simple in principle. It is essentially a box-type holding furnace which also provides for pouring the castings, and is suspended on trunions and mounted on a base. Correct temperature of the bath is maintained by an electrical indicating and controlling millivoltmeter pyrometer.

Tilting of the casting machine, and its return at the end of the casting cycle for each consecutive pour, is controlled hydraulically. To insure a uniform cycle, the machine has a timing device set to maintain the rate of pour determined by the nature of the casting.

To start operation of the casting machine which has the mold attached, contact is made by electric pushbutton control to tilt the machine. The molten metal then flows through the gate and by gravity follows the lowest channel of the cavity and rises progressively as the mold is filled. The metal begins to solidify at the furthermost point from the furnace, and solidifies progressively toward the gate or furnace end. It is held in the tilted position sufficiently long to solidify the casting and a small portion of the gate which at this time assumes the role of a riser. Upon the machine's return to horizontal position, the liquid portion of the gate is returned to the bath.

In producing the cylinder block casting, the mold was first heated to 400° F, after which it was sprayed with a special preparation consisting of graphite, water glass and water. It was then heated to approximately 750° F, preparatory to pouring the first casting. From the first casting it was possible to detect that the die had not absorbed all the heat it was capable of absorbing, nor had it as yet reached a thermal balance which it must do before castings can be made. When the proper die temperature was reached, when the proper spray procedure was established, and when the casting cycle was adjusted to the progressive solidification of the casting, it was possible to pour one casting after another and proceed with the production of sample castings for the inspection and approval of the customer.

Keep Record on Job

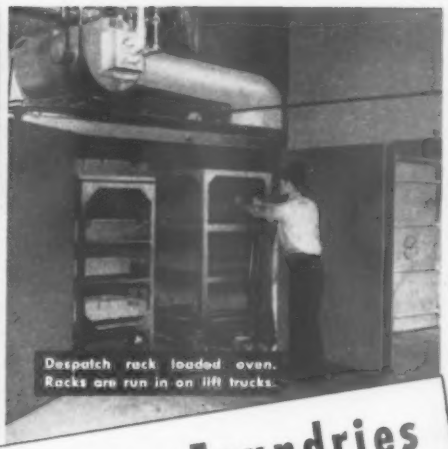
The operator of the tilting machine plays an important part in the process. He must become familiar with and co-ordinate the various operations of the mold, the machine, the use of spray, etc. On each job a careful log is kept so that metal and mold temperatures are recorded, proper spray techniques followed, and the pouring cycle adjusted to the specific requirements of the casting. This practice has proven invaluable in shortening down-time in the foundry.

In its application of the Wessel system of permanent mold casting, of which it is one of the first licensees, the Progress plant works with both full permanent molds (metal molds and metal cores) and with semipermanent molds (either metal molds with sand cores or metal molds utilizing both metal and sand cores). Type of core used is established by the requirements of the casting to be made.

For its operations the company maintains its own pattern shop, die shop, sand casting foundry, modern coreroom, permanent mold foundry, and also heat-treating and x-ray equipment. It occupies a floor space of 34,580 square feet.

PLANT VISITATION: A group of industrial engineers from Ohio University, under the direction of Dean E. J. Taylor (extreme left, back row), visited the Jackson Iron & Steel Co., Jackson, O., recently. Wilfred H. White, company metallurgist, talked briefly on the plant operation. After the tour the group lunched in the company commissary. Photo by Mr. White

Despatch vertical type, continuous conveyor oven for limited floor space.



Despatch rack loaded oven. Racks are run in on lift trucks.

Core baking horizontal conveyor type oven in the Oliver Foundry.

Nation's Leading Foundries Bake Cores—Dry Molds Better, Faster and at Greater Savings with DESPATCH FOUNDRY OVENS

Despatch mold drying and core baking car type oven.

Despatch rolling drawer type oven. Ideal for large or small cores.

Many foundries using DESPATCH Ovens report improved core and mold quality with a minimum of rejects, reduced fuel cost up to 57% by actual test and increased output up to 70% with the same floor space. These advantages and many others are achieved with the DESPATCH system of convection heating and air circulation. Core baking and mold drying are more uniform because of the equal distribution of heated air to each unit of the load . . . it is done faster because heat transfer is speedy and moisture and fumes are removed quickly.

DESPATCH heating systems are designed to supply adequate heat for highest possible core and mold oven efficiency, whether gas, oil or electricity is used. DESPATCH Foundry Ovens are engineered and built to fit every core baking and mold drying operation. Several types are shown, and there are many combinations to fit the production and space requirements of all foundries.

DESPATCH engineers will analyze your core baking and mold drying problems and make their recommendations to save you production time at the lowest practical cost of installation. There is no obligation for this engineering service.

WRITE TODAY for Bulletin 31J or request a representative to call.

MINNEAPOLIS OFFICE:
619 S. E. 8th Street

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7070 N. Clark Street

Continuous conveyor leaving Despatch overhead core baking oven in J. I. Case Foundry.

DESPATCH
OVEN COMPANY

Alloys of Magnesium Containing Zirconium

(*Continued from page* 95)

dried and charged with the metal, so it could be melted as the metal melted, and the chance for hydrogen pickup could be reduced.

Effect of Remelting — Zirconium readily settles to the bottom of the melting pot due to gravity. Consequently, salt must be added to the metal each time that it is melted. As an example, an analysis of Melt 9202 showed the zirconium content to be 0.83 per cent, but when it was remelted without any zirconium salt addition, the zirconium content dropped to 0.56 per cent.

Ternary Magnesium Alloy—H. Altwicker[2] states that beryllium, aluminum, manganese, tin, antimony and nickel are not suitable for alloying with magnesium-zirconium alloys. These metals apparently reduce the solubility of zirconium in magnesium, consequently their use results in alloys with a coarse grain size and low mechanical properties. It is noted that beryllium does not cause grain growth in magnesium alloys when tin is present. These alloys, however, were not improved by an addition of zirconium.

German research indicated that the most interesting metals for improving the properties of magnesium-zirconium alloys are zinc and cadmium. It was found that zinc raised the tensile and yield strength but decreased the elongation. An addition of very small amounts of cadmium had little influence on magnesium-zirconium alloys, but an addition of 5 per cent cadmium effected improvement in tensile and yield strength of about 1500 psi. Ten per cent cadmium did not produce a greater effect.

A further conclusion of the German research was that magnesium-zirconium alloys containing zinc and cadmium were found to have compounds capable of precipitation. This precipitation takes place so slowly that during solidification the alloys remain oversaturated. For this reason they need only aging to improve their mechanical properties. Aging temperatures varied 275 to 545° F.

These observations have been confirmed by research at the Air Materiel Command. Work here, however, has been concentrated on alloys in the magnesium-zinc-zirconium system, because it was felt that the increase in specific gravity resulting from the use of large amounts of cadmium was not balanced by a sufficiently large increase in mechanical properties.

It has also been noted that unless the zirconium-containing salts are thoroughly dried before alloying with magnesium, there is no grain refinement and the amount of zirconium in solution is small. It is suspected that this grain coarsening may be due to hydrogen getting into the metal and reducing the solubility of zirconium.

Best results were obtained with an alloy containing 4 per cent zinc, 0.7 per cent zirconium, balance magnesium. Melt 9198 was prepared using a salt containing 25 per cent sodium chloride, 50 per cent zirconium chloride, and 25 per cent potassium chloride. Melt 9200 was prepared using dense zirconium chloride.

Properties of these melts were:

No. 9198—Yield strength 26,200 psi; ultimate strength 39,400; elongation 8.5 per cent.

No. 9200—Yield strength 26,900 psi; ultimate strength 39,500; elongation 7.5 per cent.

These bars were cast and aged 16 hours at 350° F.

Heat Treatment—The best mechanical properties were obtained from bars that were given only an aging treatment. Bars that were given a solution heat treatment of 36 hours at 730° F, air quench and age of 16 hours at 350° F had mechanical properties that were inferior to the mechanical properties of bars that were

(*Concluded on page* 158)

OBITUARY

WILLIAM W. Bowring, sales engineer, Frederic B. Stevens Inc., Detroit, died Oct. 30. Mr. Bowring, a native of De Pere, Wis., following graduation from high school, entered the foundry of C. A. Lawton Co. there, where he became superintendent, supplementing his experience with courses in drafting and other technical subjects. In 1916 he moved

WILLIAM W. BOWRING

to Detroit and became associated with Frederic B. Stevens Inc. Mr. Bowring was active in the Detroit Chapter of the AFS, serving as treasurer for more than ten years and as chairman in 1947-48.

* * *

Hans Carlson, 61, inspection department foreman, Campbell, Wyant & Cannon Foundry Co., Muskegon, Mich., died Oct. 15. Mr. Carlson had been associated with the company for 27 years.

* * *

Frank L. Gorman, 55, who was engaged in foundry production work in Cleveland for 27 years, died at his home there Nov. 7. Mr. Gorman was graduated from St. Ignatius College, now John Carroll University. For 25 years he was associated with Allyne-Ryan Foundry Co., where he became supervisor. He became manager of the former Nickel Plate Foundry Co. in 1945, remaining there until 1947 when he entered the real estate business.

* * *

Charles A. Boyd, 82, formerly works manager, Kilby Mfg. Co., Cleveland, died at his home there Nov. 5. Mr. Boyd was graduated from Rose Polytechnic Institute, served as a departmental chief engineer, Baltimore & Ohio Railroad, and later became works manager for Johnson & Jennings Co. and Wellman Engineering Co., Cleveland. Since his retirement from Kilby Mfg. Co. in 1934, he had engaged only in consulting work.

* * *

Julius S. Holl, 64, advertising manager, Link-Belt Co., Chicago, died Oct. 24. Mr. Holl joined the J. M. Dodge Co., Philadelphia, a subsidiary company, in 1905. He was subsequently transferred to the parent company's Philadelphia plant and moved its advertising department to Chicago in 1911. Mr. Holl was a past president of the National Industrial Advertisers Association.

* * *

August Spindler, 84, president, August Spindler & Sons Inc., Jersey City, N. J., manufacturers of brass castings, died at his home there Nov. 6.

* * *

Albert J. Love, 65, president and general manager, Love Bros. Inc., Aurora, Ill., died Oct. 25 in that city.

* * *

George W. Miller, 68, personnel manager, Atlantic Foundry Co., Akron, O., died there Oct. 10.

DEMMLER No. 55 CORE BLOWERS

CUT CORE BLOWING COSTS 30%

FOR PEORIA MALLEABLE CASTINGS CO.

Anna Gerhards and Dewey Rakestraw of Peoria Malleable Castings Co. are seen at their DEMMLER NO. 55's. Being blown are chain cores and ball type trailer hitch cores.

Here, indeed, is a real success story — one that every foundry can share.

It concerns Peoria Malleable Castings Co. of Peoria, Illinois, who, through the purchase of six DEMMLER NO. 55 Core Blowers, reduced their small core blowing costs by 30%!

Peoria Malleable Castings had previously used other makes of small core blowers, but now DEMMLER NO. 55's carry the load — efficiently and profitably.

Quality of cores produced by the DEMMLER machines, reports Peoria Malleable Castings Co., is excellent, being extremely uniform and far superior to that of hand made cores.

The experience of Peoria Malleable Castings Co. is not an isolated case. Hundreds of other foundries are also enjoying the "extra profits" DEMMLER NO. 55 Core Blowers make possible.

Are you one of them?

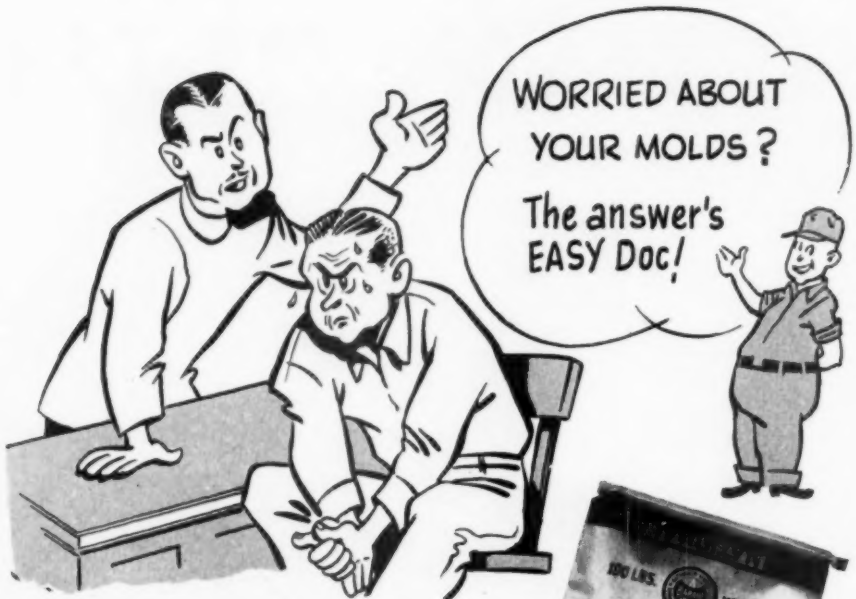
Features

- Ideal for short run jobs
- Quick, easy adjustments for raising table and moving chuck jaws
- Sliding, quick change blow plates
- Trouble-free diaphragm type blow valve
- Sand magazine and carriage of aluminum castings, with ball bearings
- Will accommodate boxes 9 inches long — handle cores weighing up to 4 pounds
- A single hand valve operates both vertical and horizontal core box clamps and blows the core
- Moderately priced

Write for illustrated DEMMLER NO. 55 specification sheet — today!

Wm. DEMMLER & BROS.
KEWANEE, ILLINOIS

MANUFACTURERS OF CORE BLOWERS EXCLUSIVELY SINCE 1911



CONSISTENTLY HIGH QUALITY

NATIONAL BENTONITE

takes many worries from a foundryman's mind, because it gives molding sands maximum green strength with low moisture content, thus lessening the danger of gas holes or blows. National Bentonite also gives high dry strength . . . . . excellent hot strength at 2500° F. Provides harder cores, too.

These APPROVED DISTRIBUTORS will give you quick service.

American Cyanamid Co.
New York, New York
The Asbury Graphite Mills, Inc.
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Kansas City, Missouri (main office)
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Oklahoma City, Okla.
Wichita, Kans.
Dallas, Texas
Houston, Texas
New Orleans, La.
O. W. Bryant Core Sands, Inc.
McConnellsville, New York
Canadian Industries, Ltd.
Montreal, Quebec, Canada
(all branches)
Casco S. de R. L.
Mexico, D. F.
Combined Supply and Equipment Company
215 Chandler St.,
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Coldwater, Michigan
Also Detroit, Michigan
Foundry Service Company
North Birmingham, Alabama
Foundry Supplies Co.
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Robert C. Penner
Interstate Supply & Equipment Co.
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Los Angeles, California
Industrial Foundry Supply Co.
San Francisco, California
Klein-Farris Co., Inc.
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Portland, Oregon
Marthens Company
Moline, Illinois
Carl F. Miller & Co.
Seattle, Washington
Pennsylvania Foundry Supply & Sand Co.
Philadelphia, Pennsylvania
Robbins & Bohr
Chattanooga, Tennessee
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Minneapolis, Minnesota
Southwest Foundry Supply Co.
Houston, Texas
Steelman Sales Company
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Wehenn Abrasive Co.
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BAROID
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BENTONITE SALES OFFICE
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(*Concluded from page* 156)

given only an age of 16 hours at 350° F. Properties of bars given the two types of treatment were:

Heat treat and age—Tensile yield strength 22,300 psi; ultimate tensile strength 39,600 psi; elongation 10.5 per cent.

Age only—Tensile yield strength 27,900 psi; ultimate tensile strength 40,100 psi; elongation 9 per cent.

Solution heat treatments up to 950° F produced no improvement in mechanical properties. Tensile yield strength and ultimate tensile strength remain about constant, but elongation values decreased if the bars were heated above 900° F.

The following bars were held for 20 hours at the indicated temperature, then aged for 20 hours at 350° F:

Solution temperature 850° F—Tensile yield strength 21,000 psi; ultimate strength 39,000 psi; elongation 6 per cent.

Solution temperature 900° F—Tensile yield strength 22,000 psi; ultimate tensile strength 34,500 psi; elongation 6 per cent.

Solution temperature 950° F—Tensile yield strength 23,000 psi; ultimate tensile strength 39,500 psi; elongation 5 per cent.

Increasing the aging time had no noticeable effect. Bars aged for 36 hours at 350° F had the same mechanical properties as bars aged for 16 hours.

Conclusions — Magnesium-zinc-zirconium alloys possess mechanical properties which are appreciably better than those commercially available today. Furthermore, the magnesium-zirconium alloys containing zinc have compounds capable of precipitation, and this precipitation takes place so slowly that during solidification the alloys remain oversaturated. For this reason they need only aging to improve their mechanical properties.

The best method for introducing zirconium into magnesium alloys was found to be through the use of zirconium salts. Best results were achieved with zirconium chlorides, either dense zirconium chloride, or a mixture of 50 per cent zirconium chloride, 25 per cent sodium chloride, and 25 per cent potassium chloride. The salt must be thoroughly dried before it is introduced.

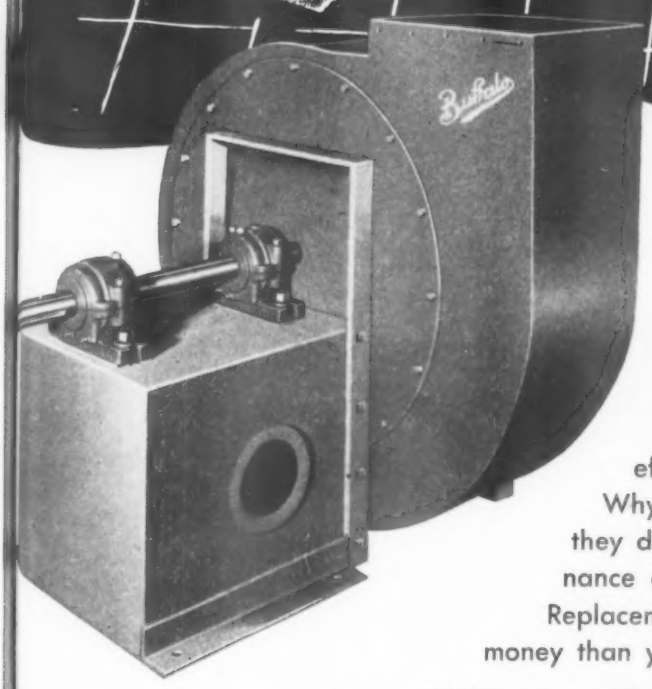
References

1. Altwicker, H., "Zirconium in Magnesium," ATI No. 27205, Hq. Air Materiel Command, August 1948
2. Altwicker, H., "Ternary Magnesium Alloys Containing Zirconium," ATI No. 22439, Hq. AMC, January 1949
3. Ball, C. J. P., "Outstanding Properties of the Magnesium-Zirconium Alloys," *Metallurgia*, January 1947 and February 1947
4. Horn, E. and Strader, M., "Experimental Magnesium Alloys Containing Zirconium," ATI No. 39705, Hq. AMC
5. *Elektron Magnesium Alloys*, publication of Magnesium Elektron Ltd., Clifton Junction, England.

Everyone Admits

"A New Broom Sweeps Clean"

THAT'S ONE REASON WHY IT PAYS TO REPLACE WORN-OUT EXHAUSTERS WITH "Buffalo" EXHAUSTERS



— and what a "cleaning" job these new "Buffalo" Industrial Exhausters can do! They're of welded steel plate for extra years of service. Smooth, *rivet-free* interior surfaces mean extra-efficient gas handling or material conveying. Why not make a check of *your* plant exhausters? Are they doing the job? Or are they siphoning off maintenance and power dollars that could well be saved? Replacement by "Buffalo" can well save you more money than you think.

WRITE FOR YOUR FREE COPY of Bulletin 3576 and see the performance and application information on these exhausters used industry-wide. Also write for Bulletins 3222-F and 3615-A for other "Buffalo" fans for exhausting applications.

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

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Canadian Blower & Forge Co., Ltd., Kitchener, Ont., Branch Offices in all Principal Cities

VENTILATING FORCED DRAFT | AIR WASHING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

Industry BRIEFS

AMERICAN Steel Foundries, East St. Louis plant, 2039 East Broadway, East St. Louis, Ill., observed its fiftieth anniversary Oct. 14 with a family day open-house celebration. More than 2500 persons attended.

* * *

Eagle Foundry Co., Belleville, Ill., has been sold to a syndicate represented by W. A. Shea, New York attorney. M. G. Klemme, foundry president-treasurer, said there would be no change in management or company policies.

* * *

Fairchild Engine & Airplane Corp., Farmingdale, L.I., N. Y., has licensed Metallgesellschaft, A. G., Frankfurt am/Main, Germany, to use and sublicense Fairchild's process of molecularly bonding aluminum to ferrous metals.

* * *

Jeffrey Mfg. Co., Columbus, O., has moved its West Virginia district office from Huntington to 403 City Ave., Beckley. E. H. Hebden is manager. Company's Cleveland district office, formerly in the Rockefeller building, now is located at 1560 Hanna building. J. W. St. John is manager.

* * *

Hyster Co., 2902 N. E. Clackamas St., Portland 8, Oreg., has appointed two new dealers: French Mill Supply Corp., 640 Varick St., Utica, N. Y., with James B. French as president and general manager, and Speer & Co., 7824 Hamilton Rd., Mt. Healthy, Cincinnati, with A. Burns Speer and Charles W. Mayer in charge of the new company. Richmond Auto Parts, Richmond, Va., another Hyster dealer, has opened a branch sales office, Virginia Bearing & Supply Co., 354 Salem Ave. S. W., Roanoke, Va. H. D. Zimmerman is branch manager.

* * *

Bay State Abrasive Products Co., Westboro, Mass., has appropriated $100,000 for factory expansion and manufacturing equipment. This sum supplements $250,000 appropriated in May for an expansion program now under way.

* * *

Milwaukee Die Casting Co., 1015 North Fourth St., Milwaukee, has begun construction of a new plant on North Holton St., just north of West Capitol Dr. The development, including cost of land, construction and equipment, will cost about $300,000 and will contain 44,000 sq ft of floor space.

* * *

Cleveland Tramrail Division, Cleveland Crane & Engineering Co., Wickliffe, O., has appointed the following representatives: Cleveland Tramrail Division, Material Handling Equipment Co., 30 Church St., New York 7; Cleveland Tramrail Division, John W. & Wm. H. Carlson, 23 North Ave. N. W., Atlanta 3; and Cleveland Tramrail California Co., 4700 District Blvd., Los Angeles 58, and 503 Market St., San Francisco 5. The latter is the same organization that served San Francisco previously as Tramrail Engineering Inc.

* * *

Lone Star Steel Co. has started production of cast iron pressure pipe at its foundry in Longview, Tex.

* * *

Kornburger Pattern Works Inc., Milwaukee, recently was formed by Fred H., Harry A., Ralph W., and August Kornburger, 3118 North 31st St., Milwaukee.

* * *

Sterling Electric Motors Inc., 5401 Anaheim-Telegraph Rd., Los Angeles 22, has acquired an 11-acre site in Van Wert, O., for construction of a branch plant to cost an estimated $500,000.

* * *

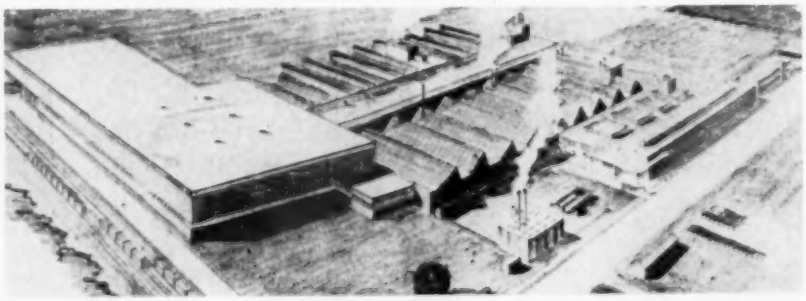
Detroit Electric Furnace Division, Kuhlman Electric Co., Bay City, Mich., has appointed two new agents: Eastern Foundries Supplies Inc., 109 Frelinghuysen Ave., Newark, N. J., with W. C. Russell, D. M. Warren Jr., and R. N. Moore handling furnace assignments; and Interstate Supply & Equipment Co., 647 West Virginia St., Milwaukee 4, with R. C. Penner and Walter Haase handling furnace work.

* * *

John Westwick & Son Inc., Claude & Meeker Sts., Galena, Ill., a gray iron foundry, has been purchased by Joseph V. Shanley and G. A. Shanley, president and secretary, respectively, of Garden City Foundry Co., 7219 North Wolcott St., Chicago. Operations will continue under the Westwick name with W. G. N. Heer, formerly research metallurgist, Battelle Memorial Institute, Columbus, O., as superintendent.

* * *

Chicago locations of Hewitt-Robins Inc. have been consolidated at 402 West Randolph St., where offices and warehouses will be located for Hewitt Rubber, Robins Conveyors and Robins Engineers Divisions. Enlarged warehouse space permits greater on-hand stocks of hose, belting and other industrial rubber products, as well as conveying and vibrating machinery items. Hewitt Restfoam Division will remain in the Furniture Mart, Chicago.



NEW BUILDING: Albion Malleable Iron Co., Albion, Mich., plans construction of a 91,000-sq-ft addition to provide modern facilities for trimming, annealing, cleaning, finishing and shipping operations. The L-shaped building, 440 x 240 ft along the sides of the L with 30 ft clearances under all trusses, will permit improved operating efficiency and increased capacity. Older buildings will be razed and some railway sidings are to be relocated. The program involves an expenditure of $1,300,000

Specify SPO for Top Quality Production Molding Machines

MODEL No. 2222

JOLT–SQUEEZE–STRIP MOLDING MACHINE

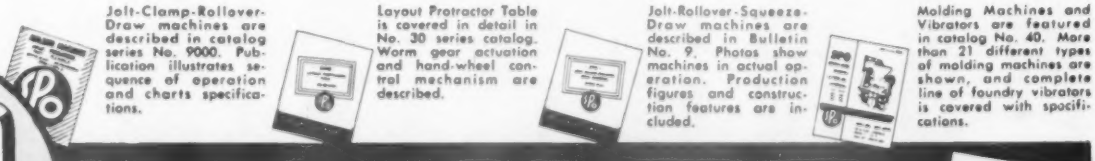
● Today's production requirements are higher than ever—and only SPO has designed its foundry equipment to meet these demands.

CHECK THESE FEATURES: Push Button Control . . . Fully Automatic Cycle . . . Famous SPO inverted jolt mechanism . . . Powerful Squeeze performed by 22" diameter cylinder . . . Dual-mounted squeeze plate . . . Automatically aligned Stripping Mechanism . . . and Automatic Pattern Draw at the desired pre-set speed of operation.

In production, Model No. 2222 jolt-squeeze-strip molding machine is operated entirely by the sequence-arranged push buttons to perform all functions. In addition, jolt-squeeze and vibration operations are timer-controlled to assure production quality of cope and drag molds of uniform standard. Squeeze capacity of this new molding machine is 28,000 pounds and the jolt capacity is 2500 pounds. Model No. 2222 automatic machine has a 36" x 51" table and pattern draw of 12".

From the drawing boards of SPO engineers come the finest and most modern foundry equipment in the world. Step-up your production and reduce your molding costs by SPECIFYING SPO EQUIPMENT THROUGHOUT YOUR FOUNDRY.

Write today for catalog Series No. 200.



Jolt-Clamp-Rollover-Draw machines are described in catalog series No. 9000. Publication illustrates sequence of operation and charts specifications.

Layout Protractor Table is covered in detail in No. 30 series catalog. Worm gear actuation and hand-wheel control mechanism are described.

Jolt-Rollover-Squeeze-Draw machines are described in Bulletin No. 9. Photos show machines in actual operation. Production figures and construction features are included.

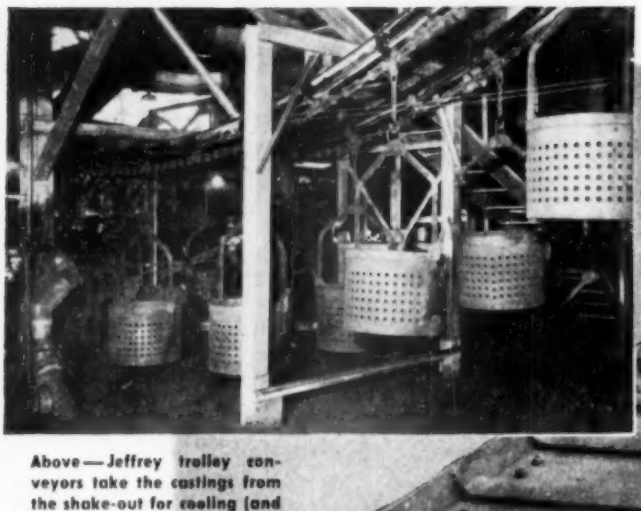
Molding Machines and Vibrators are featured in catalog No. 40. More than 21 different types of molding machines are shown, and complete line of foundry vibrators is covered with specifications.

SPO INCORPORATED

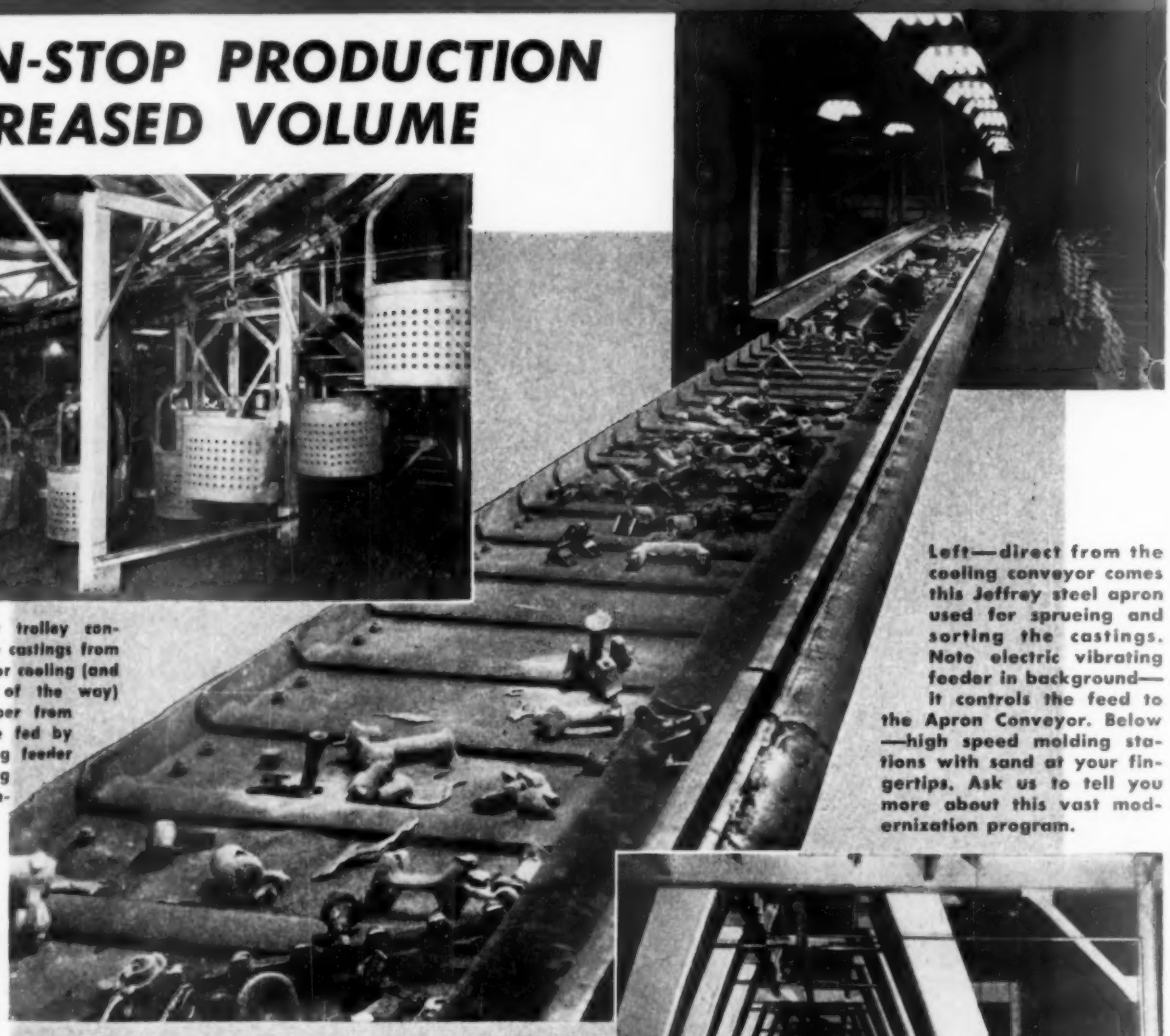
6449 GRAND DIVISION AVENUE • CLEVELAND 5, OHIO

COMPLETE MECHANIZATION *Proves Out*

NON-STOP PRODUCTION INCREASED VOLUME



Above—Jeffrey trolley conveyors take the castings from the shake-out for cooling (and overhead out of the way) thence to hopper from which they are fed by electric vibrating feeder to the sorting and sprueing conveyor (right).



Left—direct from the cooling conveyor comes this Jeffrey steel apron used for sprueing and sorting the castings. Note electric vibrating feeder in background—it controls the feed to the Apron Conveyor. Below—high speed molding stations with sand at your fingertips. Ask us to tell you more about this vast modernization program.

Completely modernized and Jeffrey-equipped throughout, this large Malleable Foundry has the facilities to turn out large quantities of castings quickly . . . is set up to meet today's prices. Yes, some Jeffrey unit is in there doing its bit to speed the process all along the line (see photos). And you'll like the way Jeffrey Foundry Engineers step up production . . . the way they coordinate each unit to provide peak efficiency and increased volume. A complete line of equipment to make your foundry (small or large) as modern as possible. Let us show you what we can do.

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PREPARATION OF SAMPLES FOR METALLOGRAPHIC EXAMINATION

By G. W. Graves
Buehler Ltd.

Good sample selection requires that first, the sample should be identical chemically and structurally to the material which it represents. Second, it must be polished so that the true structure will be revealed by etching. This means that only an extremely thin layer of disturbed metal remains. Third, it must be free from scratches, pits and tarnish. Fourth, the inclusions must be preserved intact. Fifth, it must be flat enough, even at the edges, to permit examination at high power. Meeting these conditions is difficult.

The preparation of samples has been the subject of great study and experimentation. Many improvements in machines, abrasives, and techniques have been made and procedures have been standardized for preparing most metals and alloys. Results still depend on the skill of the operator.

There are several requirements which every technician must learn and observe. These appear so obvious that they should hardly need to be stated, but probably fifty per cent of beginners' failures can be traced to the neglect of these precautions. First, cleanliness is an absolute necessity. We must pass through several grades of abrasives, each of which must be entirely removed from the specimen and hands before proceeding to the next. Foreign material must be entirely excluded. Second, the layer of disturbed metal which is of necessity created in the grinding process must be thin enough to be removed by the next step. Third, use a light even pressure on the sample.

There are many factors to be considered before a satisfactory sample can be chosen. It may be necessary to polish more than one. If the examination is to be of the surface of the material as in the measurement of plating thickness or the examination or measurement of carburized or nitrided cases, the proper section must be taken so that the significant surface may be studied. In rolled materials two samples, a transverse and longitudinal section, should be studied as the grains and inclusions have been elongated and recrystallization may or may not have occurred. Two samples should also be taken of forgings. Several samples may be required to detect and determine the extent of segregation. In castings, the structure and porosity may differ widely at various locations. In studies of failures, a sample should be taken from near the seat of the failure and one or more from a distant location so that a comparison may be made to determine any differences.

When the location of the sample has been selected it may be cut out by any one of several methods. The hacksaw or bandsaw is suitable for the softer materials. A slow feed and adequate lubrication should be used to prevent heating and smearing of the metal. The abrasive cutoff wheel is generally used for hard materials and because of its fast action and convenience it is replacing the hacksaw on soft materials. Very hard materials may be notched and fractured by hammer blows although the uneven surface requires an inconveniently large amount of grinding. Flame cutting may be the only practical method of taking a sample from a large mass. This method must be used with care on most materials as the heat will usually change the structure. Any metal heated by the torch should be removed before the sample is mounted for polishing. All methods of cutting should attempt to prevent heating. The abrasive wheel must be equipped with adequate coolant facilities. Most machines have re-circulating cooling systems which provide a flow of coolant where the wheel is in contact with the metal. The choice of the abrasive wheel is important in achieving the coolest, smoothest and fastest cutting. Most cut-off wheels are made of aluminum oxide or silicon carbide abrasive particles bonded by natural and synthetic rubber or synthetic resins. The principal variable is the bonding material, a "hard" wheel is one with a hard bonding agent and intended to cut soft materials.

A "hard" wheel tends to glaze on contact with hard metals. The bonding agent is so strong that it does not break down and allow new sharp abrasive particles to contact the metal when the first layer of particles has been dulled or pulled out. A "soft" wheel does not have soft abrasive, but does have a "soft" bonding agent and is suitable for cutting hard metals. Feeding the wheel into the work requires care. The pressure should not be enough to decrease the speed of the wheel. Any appreciable decrease in speed can be detected by the sound of the motor.

After the sample has been cut, the surface to be studied should be ground flat. This removes any metal affected by the cutting and provides a flat surface for future finer grinding. Rough grinding is ideally accomplished on a wet abrasive belt grinder. This unit cuts fast, cool and does not require dressing. Wet grinding wheels are satisfactory if they are dressed frequently to keep them flat and remove metal particles. If it is necessary to grind dry, care must be used to prevent heating. The abrasive in rough grinding varies from 20 grit in the vitrified wheels to 240 grit in the belts. A large flat mill file may be used for the soft metals in this stage. The file is placed on the bench and the specimen pushed against the teeth in one direction only to prevent rounding the edges.

After the rough grinding, the sample should be mounted to preserve the edges and provide a convenient size and shape. Samples are usually mounted in plastic in a specimen mount press. Either opaque phenol formaldehyde thermo-setting materials or water clear thermo-plastic methyl methacrylate may be used. Phenol formaldehyde is cheaper, can be molded

From *Burrell Announcer*, No. 50 10 40, published by Burrell Corp., 2223 Fifth Ave., Pittsburgh 19.

PREPARATION OF SAMPLES FOR METALLOGRAPHIC EXAMINATION

faster and is harder but conceals all but the exposed face of the sample. In molding, the specimen is placed in a cylinder, closed at the bottom. Plastic powder is poured into the cylinder which is then closed at the top by a ram. Pressure and heat are applied to the ram to melt and cure the bakelite. Methyl methacrylate must be cooled under pressure.

Samples may also be mounted in steel clamps held together by machine screws and have in the past been mounted in sulphur and the low melting point alloys. These are less satisfactory as they provide little support to the edge of the sample and tend to smear during polishing.

Fine grinding is conducted in stages on successively finer abrasives. A grit is chosen which will quickly remove the scratches left by the rough grinding. Finer grits are used until the sample has been ground by an abrasive of about 600 mesh. The most common materials for this grinding are the emery polishing papers grits 1, 0, 00 and 000. The specimen should be turned 90° after finishing each paper to make it easier to tell when the scratches from the preceding step have been removed. These papers are carefully graded and generally satisfactory. They must be used with care on motorized grinders as the finer papers are dulled rapidly and tend to burnish instead of cutting when too much pressure is used. They cannot be used with water because of the adhesive bonding. They may be lubricated, in some instances, with kerosene, graphite, or paraffin dissolved in benzene.

The newer silicon carbide wet type papers or cloths cut faster, last longer and require fewer steps. They are satisfactory for use with power grinders. These papers are clamped to the disc of a machine in place of cloth and are flooded with water or alcohol during the grinding.

A third method uses lead laps. These are metal discs upon which a layer of a lead-tin alloy has been cast. The surface is faced smooth and a thin spiral groove is cut. Abrasive is mixed with water and applied to a flat cast iron disc. The lead lap is rubbed against the cast iron disc with a lapping motion until the lead lap is flat and impregnated with the abrasive. Excess abrasive is scrubbed off and the lap is used wet on a polishing machine. At least two and usually three laps are used. They cut rapidly and leave very fine uniform scratches. More care is required with this method than with any of the others. The lead surface is easily damaged and any dirt in contact with it may become embedded requring refinishing of the lap.

Rough polishing is the most difficult step in the procedure. It requires that a surface be produced which can be polished to a mirror finish by the final step. The difficulty is the prevention of pitting, and the retention of inclusions.

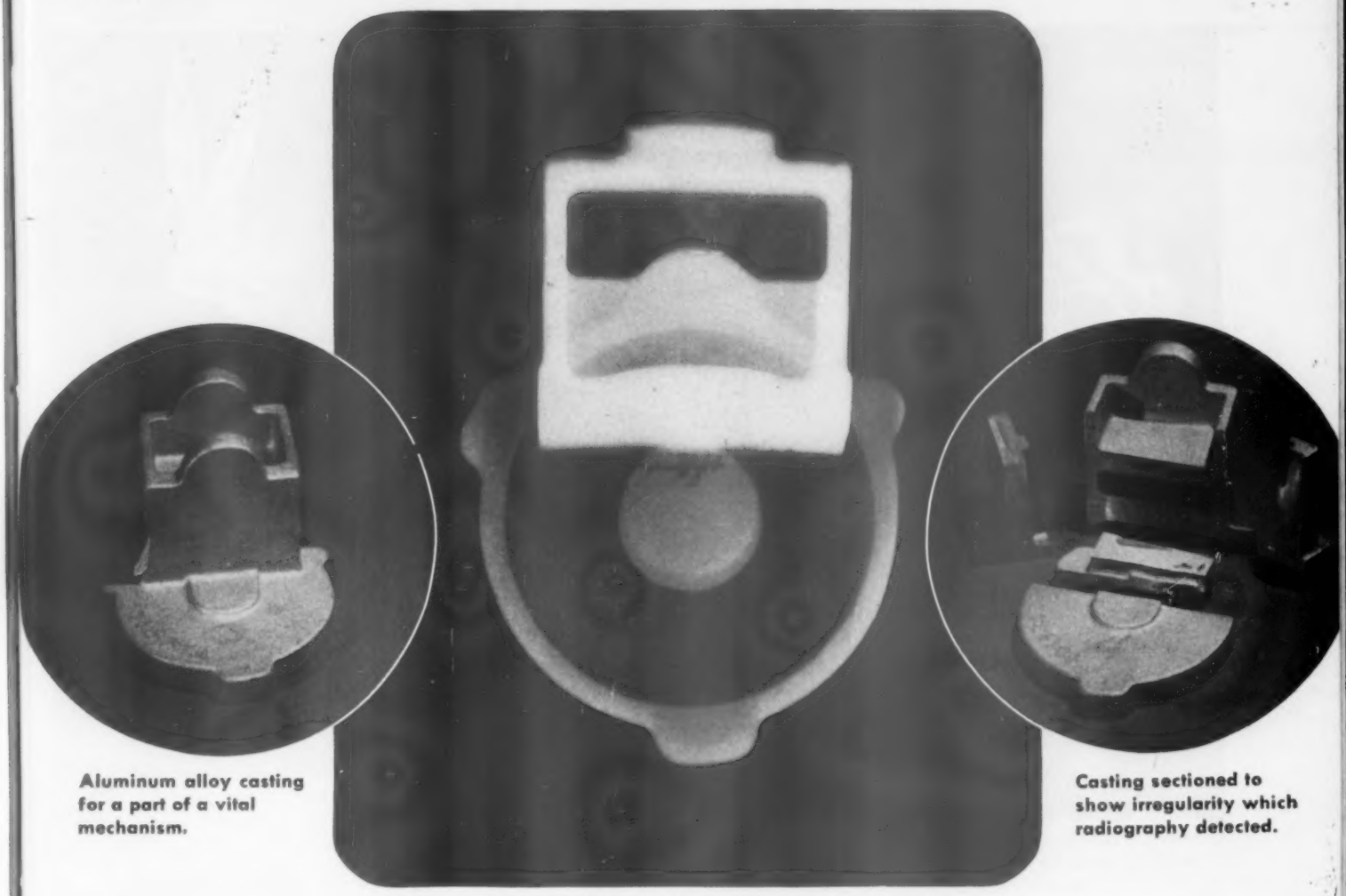
Alumina, 600 grit, used wet on a billiard cloth or canvas covered wheel is commonly used when some pitting can be tolerated. The same abrasive used on a billiard cloth which has been soaked in molten paraffin produces less pitting.

Wax wheels are also satisfactory. Hard wax may be cast on a metal wheel, faced, and grooved and the abrasive applied in a water paste. The speed of rotation is not critical, usually being between 500-1200 r.p.m. Diamond compounds can be used effectively as their extreme hardness assures a rapid cutting action.

Final polishing operation must result in a flat mirror-like surface with a minimum of worked metal on the surface and with inclusions intact. If a low power microscopical examination reveals deep or uneven scratches, pitting or rounding of the edges, the sample must be reground and prepared more carefully for the final polish. This work is done by a soft cloth covered wheel using very fine abrasives. The particle size is usually one micron or less. The speed of the wheel is between 100 and 600 rpm. Many different cloths are satisfactory. Cotton or wool with dense medium length nap, woolen broadcloth and a synthetic cloth with rayon pile cemented to a cotton backing are all widely used. Cotton or silk fabrics almost without nap are used where pitting is a serious problem. Alumina is the abrasive generally used although magnesium oxide, chrome oxide or iron oxide are also used.

Slow speeds of 150-600 rpm are preferred. The sample is usually rotated in the fingers or moved around the lap opposite to its rotation. This minimizes pitting action. A light pressure is used and only enough distilled water so that the specimen will dry in a few seconds when lifted from the wheel. When a mirror finish has been produced the sample should be washed in alcohol and dried with a hot air blast. The sample should then be etched lightly and examined under the microscope. It should then be polished on the final wheel, re-etched and again examined. If the structure appears to have changed, it is the result of removing a layer of disturbed metal. It should be re-polished and re-etched until no change occurs.

Electrolytic polishing can be used instead of mechanical polishing on many materials. The sample is connected as an anode in an electric circuit and immersed or placed in contact with an electrolyte. Stainless steel is usually used as a cathode. With properly chosen conditions including agitation, electrolyte, current density, time, temperature and previous preparation of sample, a good polish can be achieved on many specimens in 30 seconds, a great saving of time. A second advantage is that no disturbed metal is produced. This method requires a smooth starting surface. The surface is usually prepared with a 600 grit abrasive. Electrolytic polishing tends to dislodge inclusions causing pits and to round off the corners of a specimen. It also produces a gently undulating surface and a relief effect because some grains are polished at different rates from others. Electropolishing is not satisfactory on some alloys having more than one phase, cast iron and most of the cast light metals which have considerable porosity.



Aluminum alloy casting for a part of a vital mechanism.

Radiograph which revealed imperfection in the casting.

Casting sectioned to show irregularity which radiography detected.

Radiography helps prevent delays in production

ALONG with scores of other castings, this one becomes part of an intricate mechanism. Extremely high quality is a must. Machining is long, complicated, and precise. Should the casting be imperfect, not only the piece and the machining time are lost—the flow of finished parts is disrupted and a whole assembly line delayed.

This is why it pays the foundry well to check the casting radiographically. It is the one way any foundry can be certain it releases only sound castings. And, equally important, it is a way that not only detects irregularities but, at the same time, indicates ways to revise gating, venting, pouring temperature, and other variables which influence consistently good work.

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Because these photographs show the modern way with light metal castings. Here you see a booked type core box with an irregular parting and a white metal drier pattern for a manifold. The core box is about 22½ x 8½ x 5⅛ inches, weighs 37½ lbs. and costs $95.95. The white metal drier weighs 25 lbs. and costs $80.00.

Core dummy in follow board, skeleton frames for core box and drier ribbing were furnished as shown.

Hand or disc grinder finish is sufficient on faces of pressure cast core boxes, but they may be machined without fear of porosity.

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Readers' COMMENT

Students Value Publication

TO THE EDITORS:

I want to thank you for your generous and thoughtful gesture to send me THE FOUNDRY for the next year. I often wonder if the editors of technical and industrial journals and publications fully realize the importance of their papers to the student. The rapid strides that are being made in the foundry and the metals industry in general have made, in numerous instances, even the newest textbooks obsolete. The only means the instructor has at his disposal to acquaint students with the most modern industrial methods are periodicals such as THE FOUNDRY.

For example, in three of my metallurgy courses at least 50 per cent of the reading assignments have consisted of articles which recently appeared in industrial magazines. In addition, we are now preparing a foundry chemistry laboratory as an advanced foundry course project and equipment for such an undertaking is of prime interest to us. THE FOUNDRY will undoubtedly prove an invaluable source of information for me and my fellow students. May I say thanks again.

ALBIN B. CHARNESKI
1005 *Elm St.*
Rolla, Mo.

TO THE EDITORS:

Your generosity in giving me a complimentary subscription to THE FOUNDRY is deeply appreciated. It's a good feeling to know that industry is eager to help the young engineer make the grade.

I know that I shall find your magazine interesting and informative and of great help in planning my career in the foundry business.

L. J. NOWIKOWSKI
636 *Crescent Ave.*
Covington, Ky.

TO THE EDITORS:

I received your complimentary subscription for THE FOUNDRY magazine and wish to extend my thanks.

I have read the library editions of THE FOUNDRY quite regularly and have found the material presented extremely valuable to me as a student.

Needless to say, having a personal copy makes for greater convenience and provides a valuable addition to one's personal library.

Again, thank you very much for the subscription.

ROBERT L. FOLKMAN
School of Chemical & Metallurgical Engineering
Ithaca, N. Y.

Editor's Note: Complimentary copies of THE FOUNDRY are being sent to all senior engineers taking the advanced foundry course in the 12 Foundry Educational Foundation schools. Many interesting letters from these boys are received by the editors.

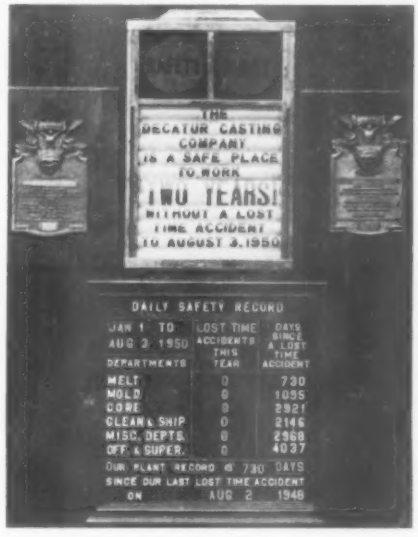
* * *

Safety Record

TO THE EDITORS:

Perhaps you will be interested in the enclosed photo giving information on the outstanding safety record made by the Decatur Casting Co.

Safety has always received prime consideration by the management and


THE DECATUR CASTING COMPANY IS A SAFE PLACE TO WORK
TWO YEARS!
WITHOUT A LOST TIME ACCIDENT TO AUGUST 2, 1950
DAILY SAFETY RECORD
JAN 1 TO AUG 2 1950
DEPARTMENTS
LOST TIME ACCIDENTS THIS YEAR
DAYS SINCE A LOST TIME ACCIDENT
MELT 0 730
MOLD 0 1095
CORE 0 2921
CLEAN & SHIP 0 2146
MISC. DEPTS. 0 2369
OFF. & SUPER. 0 4037
OUR PLANT RECORD IS 730 DAYS
SINCE OUR LAST LOST TIME ACCIDENT
ON AUG 2 1948

employees of the Decatur Casting Co. and since 1943 we have received seven achievement awards, four from the National Safety Council and three from the Michigan Mutual Liability Co. In addition we have received two first place awards from the Michigan Mutual Liability Co. for the contest years 1946-47 and 1949-50. The bronze plaques received are shown in the enclosed photo. We will also receive a first place award from the National Safety Council for the 1949-50 contest in Group C of the Metals Section.

Our record is still growing and as of today (Sept. 9) it stands at 767 days without a lost time accident.

H. E. BROMER
Resident Manager
Decatur Casting Co.
Decatur, Ind.

* * *

Asks Ralph Lee To Explain

TO THE MAN-TO-MAN EDITOR:

Upon reading September, 1950, FOUNDRY, "Man to Man" section I find myself still holding my breath, and having a feeling of being left clear out on a limb.

You have told only half the story for me. I have been in the metallurgical game for forty-six years and, unfortunately for me, I do not know Ralph L. Lee. I probably should be apologetic for this breach of knowledge and suggest there may be others in a like state of mind.

Seems to me you could, in a future issue, take us off the limb by telling us whether Ralph is a retired foundryman, an ex-college professor of metallurgy, or just an old busybody butting into a field he never had any contact with but always wanted to and could not.

My 5-in. cupola with my wife's carpet sweeper is not in it with Ralph's modern and up-to-date shop. I wonder what he makes and why. Please finish your story.

R. H. NODERER
Chief Metallurgist
Carnegie-Illinois Steel Corp.
Johnstown, Pa.

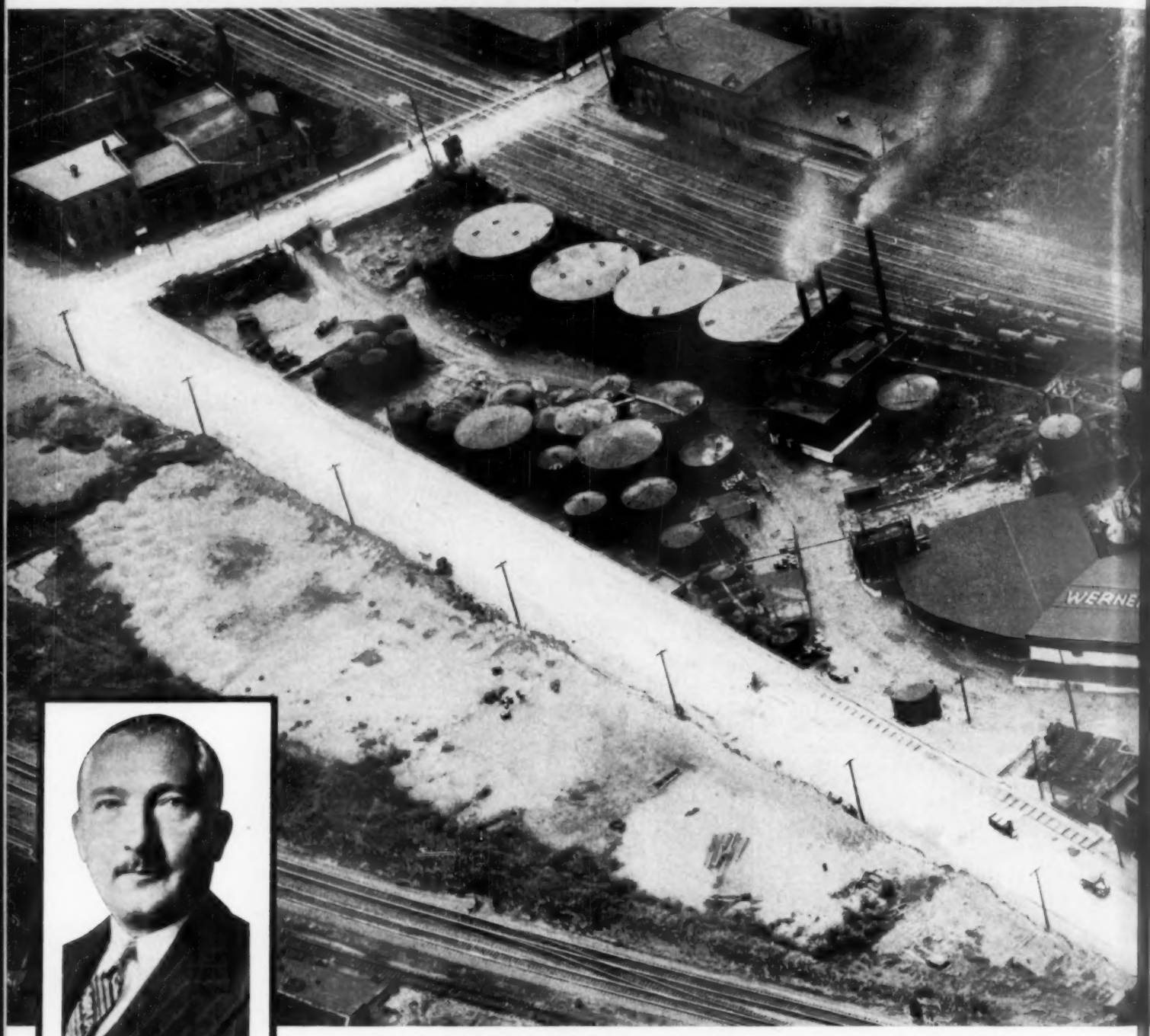
Editor's Note: For the benefit of other readers seeking answers to some of the questions asked by Mr. Noderer, we are presenting Ralph Lee's reply below.

DEAR MR. NODERER:

After getting a hearty chuckle out of your friendly letter of Sept. 28, I had to admit that you really did have a point as to my relationship (if any) with the foundry industry. No, I'm not a retired foundryman nor an ex-college professor, but as you guessed lastly, I am definitely just an old busy-body butting in, although I'm

(*Concluded on page* 170)

Here's Our Plant Now Making Th



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(*Concluded from page* 167)

not going along with you on my never having had any contact with the foundry.

With a molder for a grandfather, a dad an outstanding special machine builder and research man, and with my youth spent in mechanical and electrical experimentation, I have always gone clear out of my way to work hand in glove with the foundry, although I never made my living by actually working in it.

Possibly the main reason for adding the foundry to my home shop, which the Lee's have always had, was a belief—nigh onto an obsession—that if designers get the viewpoint which can only come from actually handling sand, and foundrymen get the viewpoint which can only come from actually handling the tee square on the board—to say nothing of the handles of lathes, milling machines, drill presses and what have you—they and everyone else concerned would be much better off.

Of course, I'm sure you suspect in this rather transparent explanation an alibi for an unreasonable yen or love for everything and anything connected with the foundry. So there, I've done the best I can.

Now as to what our one-man organization makes in the Lee Hobby Foundry. First and foremost is the equipment for the foundry: Flasks (some quite tricky), jackets, Goldberg testing equipment in every degree of impracticability, a freak molding machine, tumbler, pattern shop stuff; in fact, my son frequently makes the crack that my research projects are just thinly veiled excuses for making patterns and castings.

There is, however, one legitimate line of products made upon executive orders from the home superintendent (that's Mother, Mrs. Lee, vice president in charge). She gives the stuff away, including pin-up lamps, toy skillet ash trays, paper knives, filigree bronze picture frames and trivets, and other stuff like that.

My bread-and-butter work for many years has been with General Motors in the field of personnel and public relations, although I started out with the corporation some 36 years ago as a mechanical and electrical designer. But don't forget I had the home shop all the time.

RALPH L. LEE

Foundry Congress

The International Foundry Congress for 1951 will be held in Brussels, Belgium, Sept. 10 to 14. President of the congress will be M. Borgheroff who is well known in international foundry circles.

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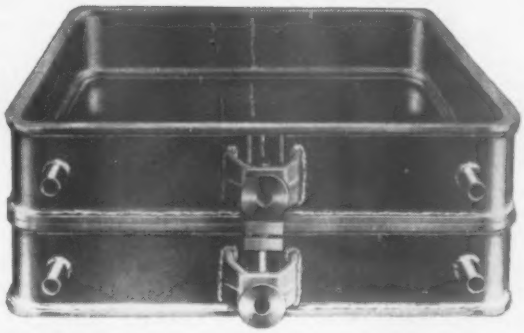

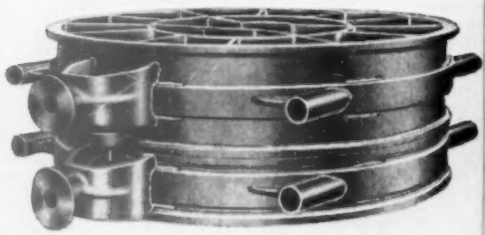

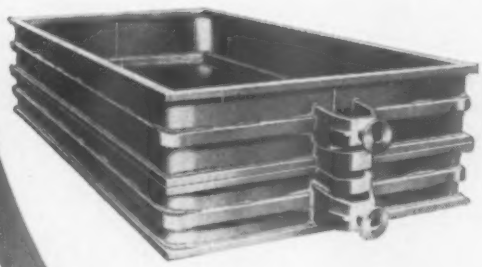

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Activities of Foundry GROUPS

Metropolitan Brass Founders

APPLICATION and production of intricate high quality castings for aircraft engines were discussed by Andrew Slachta, supervisor of the foundry and heat metallurgy unit of the materials laboratories, Wright Aeronautical Corp., Wood Ridge, N. J., in New York, Oct. 18. He spoke before the Metropolitan Brass Founders Association Inc., comprising a membership of approximately 45 foundries, at its regular monthly meeting at the Hotel Holley, New York.

He outlined in some detail the gating and risering techniques employed in the sand casting of aluminum and magnesium, illustrating his remarks with lantern slides.

Development of the association's free service to members on defense procurement information and contact award data came in for much favorable comment. This service is handled through William E. Leary, executive secretary of this association, 50 Church Street, New York.

Ontario

FIRST regular meeting for 1950-51 of Ontario Chapter of the AFS was held at the Royal York Hotel, Toronto, Ont. A discussion on "Patterns and Rigging" was presented by Alexander Pirrie, Gurney Dominion Furnaces Co., Toronto. A. Reyburn, Cockshutt Plow Co. Ltd., Brantford, Ont., served as chairman.

Mr. Pirrie's talk was divided into three parts and discussion periods were held after each part. The speaker did not try to bring out anything new, but reminded the group of many little things that help to make the production of good castings much easier.—*O. A. Davies, Canada Metal Co.*

Detroit

A FATHER and son night was held by Detroit Chapter of the AFS at the University of Michigan, Ann Arbor, Mich., Oct. 19. A tour through the several university engineering laboratories was planned for the afternoon. In the foundry students were at work making molds under careful supervision and, after pouring, were able to examine the effects of their labor. The tour also included the heat treating departments, machine shops and tool room, and the physics laboratory where the group was shown the cyclotron and synchroton.

The group then was shown the campus on its way to the Michigan Union Building where the evening meeting was held. Ray Wilcox, past chairman, presented the chapter's gavel, which is cast of gray iron, steel, malleable iron, magnesium, aluminum and bronze, to Jess Toth, Harry W. Dietert Co., who is serving as chairman this year. Mr. Toth then presented Ray Wilcox with a gift from the chapter in appreciation of his work during his term of office.

Guests introduced included Dr. Frank Roth, head of the university's foundry department; Professor Boston, head, Metals Processing Division; Dr. Pidd, the coffee speaker, who explained in layman's language the various progressive steps in arriving at the highly specialized field of high energy nuclear physics as it is studied through the operation of the synchroton. The new term "mazon" has been added to our vocabulary and Dr. Pidd explained they are particles which make up the neutron. John Grennan, instructor emeritus, talked on "Melting in the Cupola." He presented an interesting and instructive colored movie taken through ports in the cupola shell at the university's foundry during melting.—*R. Grant Whitehead, Claude B. Schneible Co.*

Reading

A JOINT meeting of the Reading Foundrymen's Association, and the Conestoga Foundrymen's Association, Lancaster, Pa., was held at the Berkshire Hotel, Reading, Pa., on Oct. 17.

Frank G. Steinebach, editor of THE FOUNDRY, discussed the importance of the foundry industry to our national economy and outlined some of the important factors in future progress. These include a more realistic approach to the problems of manpower and materials on the part of government defense agencies; greater attention to improvement in practices and in plant and equipment; lower production costs, greater safety, more attention to public relations, and a program for plant protection. But the most important feature in the future success of the industry is improvement in quality. This requires the

(*Continued on page* 175)

NORTHEASTERN OHIO Chapter of the AFS heard Clyde A Sanders, American Colloid Co., Chicago, speak at its Sept. 14 meeting. Photos by courtesy of Sterling N. Farmer, Sand Products Corp.

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BETTER PERFORMANCE in core boxes, whether blown or hand rammed, whether sand is washed and dried or crude.

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MADE IN FIVE QUALITY RANGES accommodating all local foundry and core room conditions.

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(*Continued from page* 172)
application of all available knowledge on the part of each individual worker, so that each man produces the best castings he knows how to make.

Guest of honor was Hermann P. Good, president of the Gray Iron Founders' Society, who recently returned from Europe where he attended the International Foundry Conference in London, England. Mr. Good reported on the conference and described his visits to foundries in England and on the Continent. Mr. Good is also a past president of the Reading association.

A. L. Wentzel, Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., and president of the Reading group, presided.—*W. I. Cassidy, secretary.*

Metropolitan

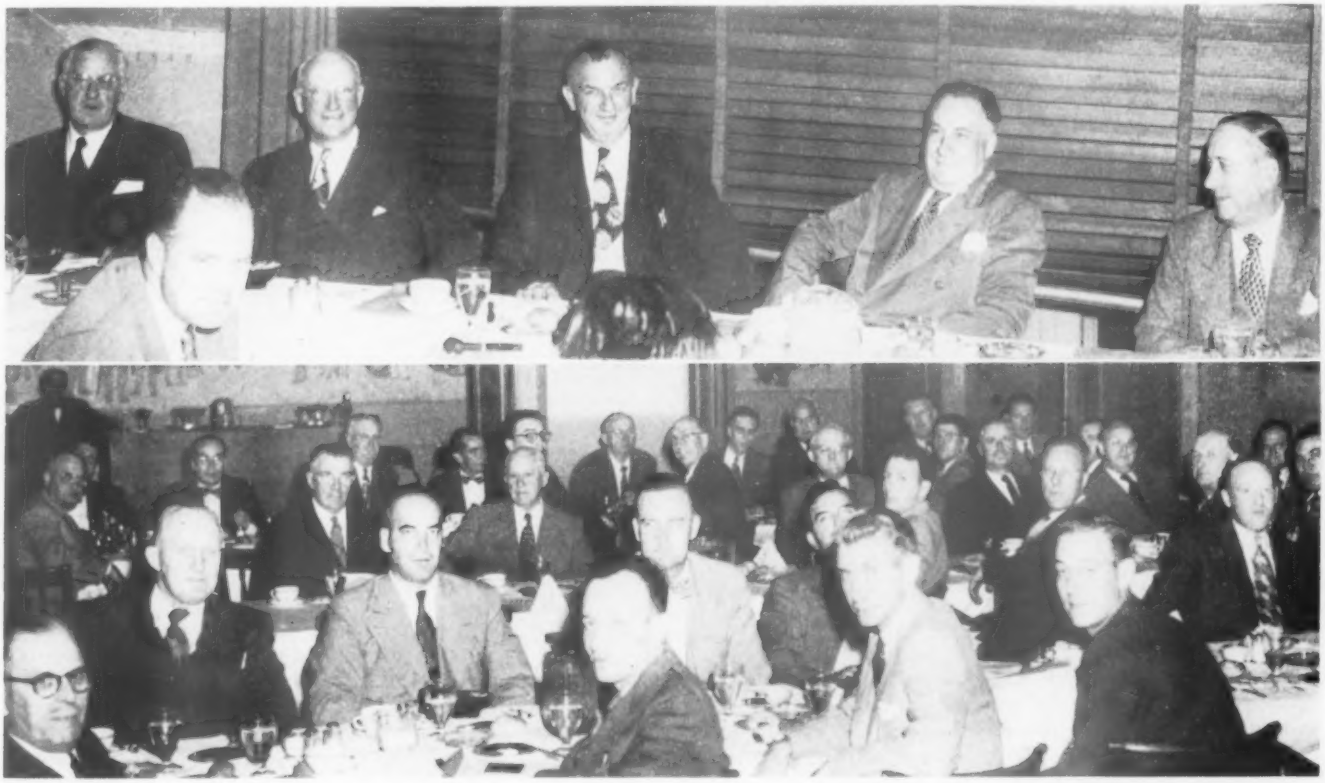
FEATURED at the Oct. 2 meeting of Metropolitan Chapter of the AFS was a talk by Bernard Ames senior metallurgist of the New York Naval Shipyard, on "Shell Molding Technique." Mr. Ames discussed the fundamental aspects of the technique as developed in the material laboratory of the shipyard. Mr. Ames devoted considerable time to a discussion of setting times and temperature; curing time and temperature and resin-sand formulas. He also described in detail the equipment used in the pilot plant. The prospects and possibilities of utilizing this process with many alloys was reviewed and a discussion of the influence of the process on the metallurgy of nonferrous alloys also was included. Mr. Ames supplemented the discussion with slides and an exhibit of shell molding, shell cores and castings.—*John R. Bing, Metropolitan Refractories Corp.*

METROPOLITAN Chapter of the AFS at its October meeting had as its speaker Bernard M. Ames, senior metallurgist, New York Naval Shipyard. He is shown at right. Robert D. Noyes, Bakelite Division, Union Carbide & Carbon Corp., is at left. Photo by courtesy of John Bing, Metropolitan Refractories Corp.

Wisconsin

REGULAR meeting of Wisconsin Chapter of the AFS was held at Hotel Schroeder, Milwaukee, Oct. 13. Since natural gas was introduced into the Milwaukee area during the past year and many industries are changing over to use of that fuel, many members were interested in the talk by J. H. Mikuta, Milwaukee Gas Co., on, "Converting Your Foundry to Natural Gas." C. P. Kotowicz, Ampco Metal Inc., was chairman of this section.

Another of the five discussions held



NATIONAL FOUNDRY ASSOCIATION members were warned at a recent Chicago meeting that "business as usual" is a thing of the past. L. E. Roark, NFA executive vice president, said the Defense Production Act will be an instrument of performance for foundrymen for the next few years. George W. Cannon, member of the advisory committee on foundry practices, Munitions Board, advised them to prepare for any eventuality. At top, left to right, are: Mr. Roark; Mr. Cannon; H. E. Ladwig, Allis-Chalmers Mfg. Co., NFA president; H. P. Kreulen, Smith Steel Division, Grede Foundries Inc., and E. B. Sherwin, Chicago Hardware Foundry Co., NFA treasurer. General view of the group is shown at the bottom

at the meeting was "Recent Developments in Precision Casting," presented by K. F. Yonker, Allis-Chalmers Mfg. Co.; A. M. Fischer, Charles Jurack Co. was chairman. Samples of wax patterns and resulting castings by this method were shown and examined by the pattern group.

The malleable iron group had I. Dennen and H. C. Weimer, Beardsley & Piper Division of Pettibone Mulliken Corp., Chicago, whose subject was "Progress in the Mulling of Foundry Sand." N. N. Amrhein, Federal Malleable Co., was chairman.

Tom Barlow, Eastern Clay Products Co., Jackson, O., addressed the gray iron group on "Gating and Scrap Castings," with L. Woehlke, Grede Foundries Co., Milwaukee, acting as chairman.

The steel group heard W. H. Owen, Harbison-Walker Refractories Co., Pittsburgh, on "The Properties and Use of Various Molding Materials Other than Silica Sand." E. G. Tetzlaff, Pelton Steel Co., Milwaukee, acted as chairman.

Before the meeting the chapter's publicity committee discussed publicity for the annual regional conference to be held in February, and also for a booth the chapter sponsored at the "Parade of Products" held at the auditorium Oct. 17 to 19. About 150 exhibitors showed their wares to executives of companies and their key officials and to students of colleges and universities of Wisconsin.—*John E. Hubel.*

NORTHERN CALIFORNIA Chapter of the AFS held its 16th annual golf party at Sequoyah Country Club near Oakland, Calif., Sept. 29. Shown at top, left to right, are: Clayton Russell, party co-chairman, Phoenix Iron Works; Peter Valentine Jr., Del Monte Properties; Ed Brumley, party chairman, Brumley-Donaldson Co.; John Russo, Russo Foundry Equipment Co., and J. M. Snyder, Joseph Musto Sons—Keenan Co. Center photo, left to right, are: Stu Love, American Brass & Iron Foundry; Charles Marshall, Industrial Foundry Supply Co.; George Stephenson, General Metals Corp.; Ed Rowe, H. L. E. Meyer Jr. & Co., and Ed Stephens, American Brass & Iron Foundry. At bottom, John Bermingham and Bill Fletcher, E. F. Houghton Co., are viewed with amusement by cigarette-holder Paul Jordan, Vulcan Iron Foundry Co. Photographs furnished through courtesy of Sam Russell, Phoenix Iron Works

Northern California

SIXTEENTH annual golf party of Northern California Chapter of the AFS was held at Sequoyah Country Club in the Oakland Foothills on Sept. 29 with 130 foundrymen and guests participating.

Success of the affair can be attributed to Committee Chairman Ed Brumley, Brumley-Donaldson Co., and his co-chairman, Clayton Russell, Phoenix Iron Works, and to the members of their committee. Sharon O'Shea, mistress of ceremonies, gave out the prizes to winners of the various events. A new feature of this year's tournament was a hole-in-one contest. The two *aces* were: Peter Valentine Jr., Del Monte Properties, and Edward M. Welch, American Manganese Steel Division.

Last prize was a large serving platter presented to S. D. Russell, Phoenix Iron Works, for being the farthest from the hole in all events—he was official photographer for the affair. —*J. M. Snyder, Jos. Musto Sons-Keenan Co.*

Eastern Canada

A LARGE number of members and guests were present at the Oct. 13 meeting of Eastern Canada Chapter of the AFS at which "Usefulness and Ill Effects of Gases in Metallurgy" was discussed by Dr. Etienne Spire, chief metallurgist, Canadian Liquid Air Co. Ltd., Montreal. Chairman L. Guilmette, Canadian Foundry Supplies & Equipment Co. Ltd., Montreal, presided.

The ill effects of hydrogen in ferrous and nonferrous metals were illustrated by photographs and graphical data and the correction of these effects by flushing molten alloys with nitrogen, in the case of nonferrous alloys, and with argon for ferrous alloys, was described.

Dr. Spire also referred to a recently developed gas flushing ladle, the result of the combined research of Canadian Liquid Air Co. Ltd., the Physical Metallurgy Laboratories of the Canadian Bureau of Mines, and Canadian Refractories Ltd. The patent discloses several designs of a porous refractory insert plug set in the refractory bottom of a ladle

(*Continued on page* 178)

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- TERMINAL WAREHOUSE Worcester 8, Massachusetts
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- WESTERN FOUNDRY SAND CO. Seattle, Washington
- WESTERN INDUSTRIAL SUPPLY CO. Portland 14, Oregon

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AND
Happy New Year

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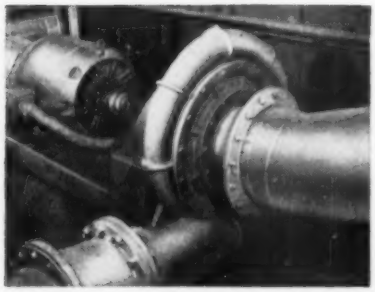
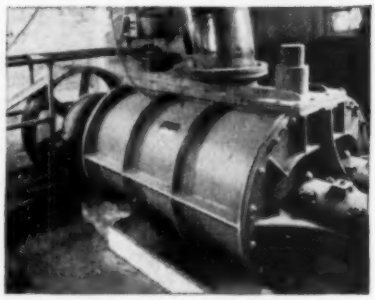


CENTRIFUGAL

Type OIB, Centrifugal Foundry Cupola Blower. Capacity 6,000 cfm.

Rotary Positive Blower, capacity 2,700 cfm in midwestern hardware foundry.

ROTARY



ROOTS-CONNERSVILLE

BLOWER BUILDERS SINCE 1854

ONE OF THE DRESSER INDUSTRIES

(*Continued from page* 176)

having a pressure chamber below with pipe connections for introducing nitrogen or argon. The inert gas so introduced through the porous plug flows in fine dispersion through the molten metal, giving a thorough mechanical removal of hydrogen in much shorter period and with less temperature loss than could be obtained previously by bubbling gas through the metal using a refractory tube inserted down into the metal. A. E. Cartwright, Crane Ltd., Montreal, acted as technical chairman during the discussion period.—*A. E. Cartwright, Crane Ltd.*

Northwestern Pennsylvania

FIRST meeting of the current season of Northwestern Pennsylvania Chapter of the AFS was held at the Moose Club, Erie, Pa., Sept. 25, with nearly 100 members and guests present. Following dinner, Chairman Frank Volgstadt, Griswold Mfg. Co., Erie, described briefly the activities planned for the year. Fred Carlson, Weil-McLain Co., Erie, co-chairman of the entertainment committee, presented a technicolor movie entitled, "Figures That Lie."

Speaker for the technical meeting was Alfred Boyles, research metallurgist, United States Pipe & Foundry Co., Burlington, N. J., who spoke on gray iron metallurgy. Slides were used to illustrate various points of the talk, and a discussion period followed.

The chapter has planned three regional meetings for the year which will be held at Meadville, Pa., Dunkirk, N. Y., and New Castle, Pa. Norman Birch and Joseph Hornstein have been named co-chairmen of the Meadville meeting; J. Marcus Morrison, chairman for the Dunkirk meeting; and Henry McKinney and Mark Baatz will be co-chairmen of the meeting at New Castle.

The critical labor supply in the Erie area was discussed by Leo Carney and Carl Minzenberger, representatives of the State Employment Service who urged that as much as possible be done to break in new help and to retain old employees.

"Sand Control," discussed by William Moore, research engineer, Meehanite Metal Corp., New Rochelle, N. Y., was featured at the Oct. 23 meeting of the chapter. Mr. Moore stated that taking daily sand tests or squeezing an occasional handful of sand does not constitute sand control; nor keeping sand within certain property limits does not mean it is under control.

Control first involves selection of

(*Continued on page* 180)

VANCORAM BRAND

Products for the Iron and Steel Industries

PRODUCT	TYPICAL COMPOSITION	APPLICATIONS
ALSIFER	Aluminum.....20% Silicon.....40% Iron.....40%	Used principally as a steel deoxidizer and for grain size control.
FERRO CHROMIUM High Carbon Grade	Chromium....66-70% Carbon.....4-6%	For wrought constructional steels and steel and iron castings.
Iron Foundry Grade	Chromium....62-66% Carbon.....4-6% Silicon.....6-9%	For alloyed cast irons. Readily soluble as a ladle addition at the lower temperatures of cast iron.
Low Carbon Grades	Chromium....67-72% Carbon...06%, .10%, .15%, .20%, .50%, 1.00% and 2.00% max.	For low carbon chromium steels, especially those with high chromium content, such as stainless and heat-resistant types.
FERRO SILICON 25-30% Grade	Silicon.....25-30%	Deoxidizer for open hearth steels; also for high silicon, corrosion-resistant iron castings.
50% Grade	Silicon.....47-52%	Used as a deoxidizer and for the addition of silicon to high silicon steels, for springs, electrical sheets, etc. Pulverized form used as ladle addition to cast irons for silicon content and graphitization control.
75% Grade	Silicon.....74-79%	For high content silicon steels, such as spring steels, sheets and forgings of high magnetic qualities for electrical apparatus.
High Silicon Grades 80-85% 85-90% 90-95%	 Silicon.....80-84.9% Silicon.....85-89.9% Silicon.....90-95%	 For high content silicon steels where small ladle additions are used for required silicon content. Also for manufacture of hydrogen by reaction with caustic soda and production of magnesium by the Pidgeon process.
FERRO TITANIUM High Carbon Grade	Titanium.....15-18% Carbon.....6-8%	Final ladle addition to control "rimming" action and to clean effervescing steel. Final deoxidizer and scavenger for steel castings and fully killed ingot steels.
Medium Carbon Grade	Titanium.....17-21% Carbon.....3-4.50%	Often preferred to the High Carbon Grade as a final ladle addition to very low carbon rimming or effervescing steels.
Low Carbon Grades 20-25% Ti Grade	Titanium.....20-25% Carbon...max. 0.10% Silicon.....max. 4% Aluminum max. 3.50%	Carbide stabilizer in high chromium corrosion-resistant steels of extremely low aluminum content. Deoxidizer for some casting and forging steels.
40% Ti Grade	Titanium.....38-43% Carbon...max. 0.10% Silicon.....max. 4% Aluminum...max. 8%	Carbide stabilizer in high chromium corrosion-resistant steels, where smaller ladle additions are desired and extremely low aluminum content is not essential.
ALUMINUM	Aluminum ... 85-99%	For deoxidation and grain size control of steel. (Ingot, shot, grain and special shapes.)
VANADIUM METAL 90% Grade 95% Grade 99.7% Grade	 Vanadium ..... 91% Vanadium ..... 95% Vanadium 99.7%	For iron-free, low-iron, or low-impurity alloys.

PRODUCT	TYPICAL COMPOSITION	APPLICATIONS
FERRO VANADIUM Iron Foundry Grade	Vanadium....38-42% Silicon.....7-11% Carbon.....about 1%	For iron foundry use. Imparts remarkable improvement in physical properties with no sacrifice of machinability; highly soluble, insuring complete diffusion.
Grade "A" (Open Hearth)	Vanadium....35-45% 50-55% Silicon...max. 7.50% Carbon...max. 3.00%	For low percentage vanadium content of rolled, forged or cast constructional steels. Also used in vanadium cast irons.
Grade "B" (Crucible)	Vanadium....35-45% 50-55% Silicon...max. 3.50% Carbon...max. 0.50%	For tool steels and special high vanadium steels in which required limits for carbon and silicon are narrow.
Grade "C" (Primos)	Vanadium....35-45% 50-55% 70-80% Silicon...max. 1.25% Carbon...max. 0.20%	For tool steels and special steels requiring high percentages of vanadium and exceptionally low carbon and silicon content.
VANADIUM PENTOXIDE Technical Grade Fused Form	V_2O_5..88-92%	A source of vanadium in basic electric furnace steels. A base for numerous chemical compounds.
Technical Grade Air Dried Form	V_2O_5.....83-85%	A base for preparation of numerous chemical compounds (catalysts, etc.).
GRAINAL ALLOYS Vanadium Grainal No. 1	Vanadium....25.00% Aluminum....10.00% Titanium.....15.00% Boron.....0.20%	Practical and economical intensifiers for controlling and increasing the capacity of steels to harden, and for improving other important engineering and physical properties.
Vanadium Grainal No. 6	Vanadium....13.00% Aluminum....12.00% Titanium.....20.00% Boron.....0.20%	See above.
Grainal No. 79	Aluminum....13.00% Titanium.....20.00% Zirconium.....4.00% Manganese....8.00% Boron.....0.50% Silicon.....5.00%	See above.
GRAPHIDOX No. 4	Silicon .....48-52% Titanium.....9-11% Calcium 5-7%	For graphitization of iron; ladle treatment insures normal graphite, free from dentritic structure; reduces chill; efficient inoculant in production of high strength irons.
V-FOUNDRY ALLOYS V-5 Grade	Chromium....38-42% Silicon.....17-19% Manganese....8-11%	Used in cast irons as a ladle addition. Reduces chill, promotes uniformity of structure, increases strength and hardness.
V-7 Grade	Chromium....28-32% Silicon.....15-21% Manganese...14-16%	See above.
BRIQUETTES Ferro Chromium	Hexagonal. Weigh approx. 3¾ lb. and contain 2 lb. of chromium.	A practical and convenient form for adding ferro-alloys to the cupola.
Ferro Silicon	Two sizes, both cylindrical, one containing 1 lb. of silicon; the other, 2 lb. of silicon.	See above.
MISCELLANEOUS	Special ferro-alloys, metals, chemicals and carbides.	To meet individual requirements.

VANADIUM CORPORATION OF AMERICA

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TENNESSEE Chapter of the AFS met at Hotel Patten, Chattanooga, Tenn., Sept. 22. Charles K. Donoho, American Cast Iron Pipe Co., Birmingham, was the principal speaker. View of the meeting is shown above

(*Continued from page* 178)

correct properties to suit the foundry involved; second, the measurement of these properties and third, the correction of the sand to hold it within those property limits. Four controls for the sand are: Grain size; clay bond; auxiliary materials; moisture.

In summarizing his talk, the speaker stated that the simpler the sand mix and the simpler the clay, the better. Complicated mixes complicate control. He advised foundries to measure accurately, mull adequately and study the condition of the castings. Above all, be sure you know why you are changing a sand mix before you change it, and then change it in the best way.

The chapter's holiday party is scheduled for Jan. 12 with Harold Lolly, foundry superintendent, Bucyrus-Erie Co., Erie, as chairman.—*Earl M. Strick, Erie Malleable Iron Co.*

Tennessee

REGULAR dinner meeting of Tennessee Chapter of the AFS was held Sept. 22 at Hotel Patten, Chattanooga. Approximately 60 members and guests were present to hear Charles K. Donoho, American Cast Iron Pipe Co., Birmingham, speak on "Nodular Iron."

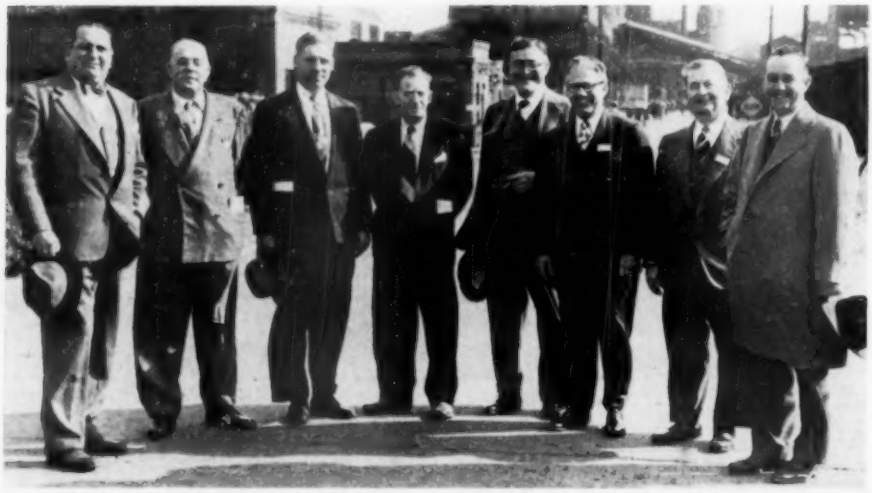
Mr. Donoho showed many slides illustrating results of experiments conducted by American Cast Iron Pipe Co. on nodular iron. Paul L. Arnold, U. S. Pipe & Foundry Co., and chapter chairman, presided and Porter Warner Jr., Porter Warner Industries Inc., vice chairman, was in charge of the program.—*Carl A. Fischer Jr., Fischer Supply Co.*

Philadelphia

FIRST meeting of the current season for Philadelphia Chapter of the AFS was held Oct. 13 with 150 members present. There was a visit to the Philadelphia Coke Co. in the afternoon and dinner was held at the Engineers' Club. B. A. Miller, Baldwin Locomotive Works, as technical chairman, introduced B. P. Mulcahy, president, Fuel Research Laboratory Inc., Indianapolis. Mr. Mulcahy discussed the five variables and fundamentals of cupola operation and use. Each subject was discussed individually and was well illustrated with slides. A long question and answer discussion followed his presentation.

Officers to serve this year are: Chairman, C. B. Jenni, General Steel Castings Co., Eddystone, Pa.; vice chairman, George H. Bradshaw, Philadelphia Navy Yard, Philadelphia; secretary-treasurer, W. B. Coleman, W. B. Coleman Co., Philadelphia. Di-

(*Continued on page* 182)



PHILADELPHIA Chapter of the AFS on Oct. 13 visited the Philadelphia Coke Co. At left, left to right, are: John M. Robb Jr., Hickman, Williams & Co.; George Bradshaw, Philadelphia Navy Yard, chapter vice chairman; Clyde Jenni, General Steel Castings Corp., chapter chairman; B. P. Mulcahy, Fuel Research Laboratories Inc., speaker at the evening technical meeting; Herman Mandel, Pennsylvania Foundry Supply & Sand Co.; and three members of Philadelphia Coke Co.—W. B. Ross, president; F. D. Miller, superintendent of manufacture, and Donald MacBrien, industrial engineer. View of the group at luncheon is shown below

THE SEASON'S GREETINGS

to all our good friends in the

FOUNDRY INDUSTRY

FREMONT MAGNESIUM FLASKS

FREMONT CAST IRON JACKETS

Built for Long Service and Fast Production!

ALL ORDERS GIVEN PROMPT ATTENTION

GROOVLOCK

THE FOOL-PROOF PIN

THE FREMONT FLASK CO.
Fremont, Ohio

CHICAGO Chapter of the AFS discussed air pollution problems at its Oct. 2 meeting. Shown at the speakers' table, left to right, are: W. D. McMillan, International Harvester Co.; Walter W. Moore, Burnside Steel Foundry Co., chapter vice president; James R. Allan, International Harvester Co., one of the evening's speakers, and C. V. Nass, Pettibone Mulliken Corp., chapter president. Photo by I. H. Dennen, Beardsley & Piper Division, Pettibone Mulliken Corp.

(*Continued from page* 180)

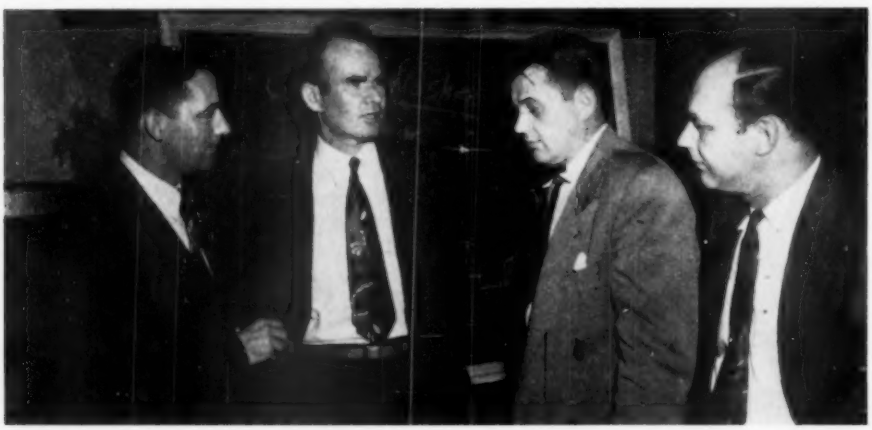
rectors are: John L. Furey, Taggart Brimfield Co.; W. A. Morley, Olney Foundry Division, Link-Belt Co.; W. F. Graden, Simonds Abrasive Co.; C. R. Tinsley, U. S. Pipe & Foundry Co.; A. N. Kraft, Wilkening, Mfg. Co.; W. Donald Bryden, Philadelphia Bronze & Brass Co.; A. A. Thum, Palmyra Foundry Co.—*Albert J. Saute, American Engineering Co.*

Quad City

CASTING Defects" was the topic at the Oct. 16 meeting of Quad City Chapter of the AFS. William A. Hambley, general manager, Wilson Foundry & Machine Co., Pontiac, Mich., was the speaker.

It was pointed out that defective castings could be classified into three general categories: Defective castings that are 100 per cent scrap, those that require a major salvage operation to make them usable, and those that require a minor salvage operation. Although the latter two groups are not a total loss, it requires additional cost to make them usable, hence the cost of repairing the castings should be taken into consideration and be included in the cost of defective castings. In those castings which require a major salvage operation, it sometimes becomes necessary to decide whether it is cheaper to repair a casting or make a new one. Also, returns from the customer and the machine shop scrap should be included in the foundry scrap.

Casting defects can be eliminated by proper training of personnel. Foremen and workmen must be made aware of causes of defects and must be made scrap conscious. To eliminate alibis, charts may be used which make changes in scrap losses more apparent than with figures. Mr. Hambley also recommended the use of published material such as the book *Casting Defects* published by the AFS and other reports of AFS committees. The speaker concluded his remarks by showing slides illustrating various defects and suggesting ways of eliminating them.—*E. C. Zirzow, Deere & Co.*



WESTERN MICHIGAN Chapter of the AFS met Oct. 2 at the Cottage Inn, Muskegon, Mich., Shown above, left to right, are: Vincent Jeannot, West Michigan Steel Foundry, Muskegon; William T. Bean Jr., director, Industrial Electronics Inc., Detroit, speaker; Charles Jacobson, Dake Engine Co., Grand Haven, Mich., and John Geboo, Campbell, Wyant & Cannon Foundry Co., Muskegon. Photo by courtesy of Frank Beetham, Campbell, Wyant & Cannon Foundry Co.

Western Michigan

OPENING the current season for Western Michigan Chapter of the AFS was William T. Bean Jr., director, Industrial Electronics Inc., Detroit. His subject was "Sound Castings Can Be Engineered." Meeting was held Oct. 2 at Cottage Inn, Muskegon, Mich., with 99 members and guests present.

Mr. Bean talked on the industrial application of Stresscoat and strain gages in the field of experimental stress analysis. His practical examples of results obtainable through this type of research emphasized the tremendous possibilities open to the foundry industry through better casting design and engineering.—*C. H. Cousineau.*

Chesapeake

OPENING its 1950 season with a joint meeting with the Conestoga Foundrymen's Association, Lancaster, Pa., on Sept. 22, Chesapeake Chapter of the AFS featured two plant visitations. The first in the morning was at the plant of the Columbia Malleable Casting Corp., Columbia, Pa. Approximately 130 members of the two groups toured the plant in groups of ten. All phases of the plant's operations were explained by a guide for each group. Following lunch the group met at York Corp., York, Pa. for a second visitation.

After the tours, members convened at the York Outdoor Country Club for the dinner and business meeting. "The History and Development of the Foundry Industry," was presented by Bruce Simpson, president of National Engineering Co., Chicago. He covered the progress of foundry practice through the different countries during various ages, referring in particular to the fine art the Chinese had developed in foundry work The lecture was accompanied by some interesting slides.

A. A. Hochrein, Federated Metals Division, American Smelting & Refining Co., and chairman of the Chesapeake Chapter, conducted the meeting and introduced H. Nelson Albright, general manager of Colum-

(*Continued on page* 184)

"We stepped-up oven capacity"

says *Ottis Lee*

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M & H Valve & Fittings Company
Anniston, Alabama

"...with faster baking cycles, thanks to MONSANTO RESINOX core bonding resins."

Many foundrymen are today *doubling* the capacity of their existing ovens—by decreasing baking cycles up to 50 per cent with Resinox-bonded cores. Result: production bottlenecks in the core room are eliminated, making it possible to increase output to meet today's stepped-up demands for metal castings.

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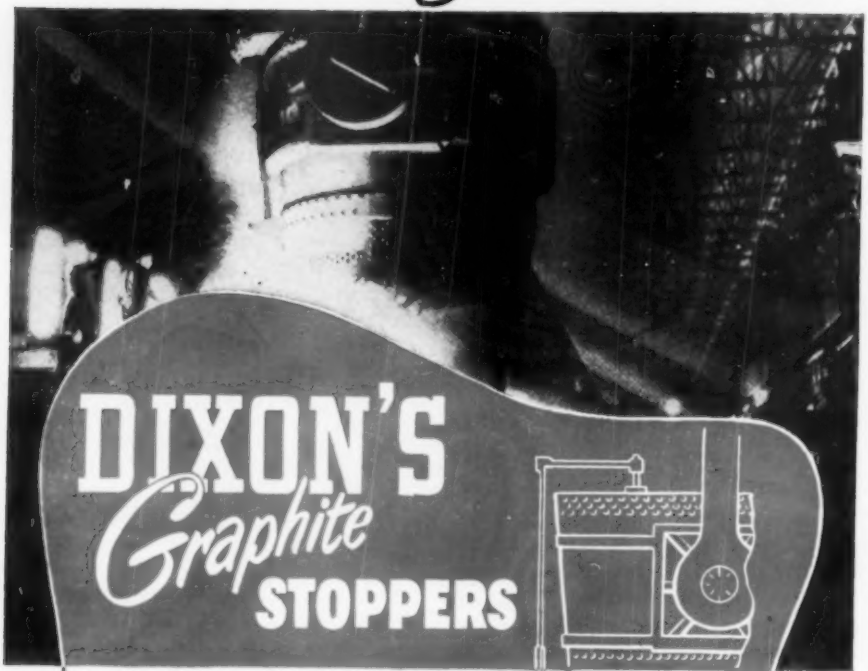

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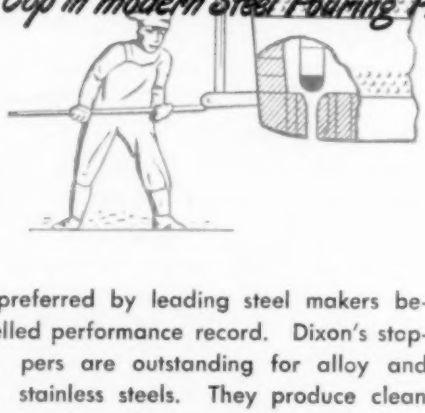

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(*Continued from page* 182)

bia Malleable, and Keith Loudon, vice president, York Corp., expressing thanks to them for making the visits to their plants possible.

T. M. Blank, Carbon Malleable Casting Co., Lancaster, Pa., and chairman of the Conestoga group was introduced.—*Arthur A. Rauchfuss Jr., Penniman & Browne Inc.*

Ohio State University

FIRST meeting of the Ohio State University Student Chapter of the AFS featured Dr. L. W. Eastwood, supervising metallurgist, Battelle Memorial Institute, Columbus, O., who presented a film showing developments in gating of light alloys.

This film records experiments which Dr. Eastwood and his associates conducted during the past year. For demonstration purposes only Dr. Eastwood used a lucite mold which enabled the observer to watch the flow of liquid in the mold. The experiments included variations in sprue and runner shapes in the same mold. Many causes of defects were found, but in spite of this, Dr. Eastwood claims he has not discovered the ideal design for runners and sprues.

Previous to Dr. Eastwood's presentation, Dr. Douglas Williams, director of the foundry course at Ohio State, informed the chapter of Professor Schneider's accidental death. He was very active in foundry work and particularly interested in its developments. His duties are being taken over by C. E. McQuiston, a recent graduate of Purdue University. —*William M. Harper.*

Central New York

REGULAR meeting of Central New York Chapter of the AFS was held Oct. 13 at the Onondaga Hotel, Syracuse, N. Y. Chapter Chairman David Dudgeon Jr., Utica Radiator Corp., Utica, N. Y., presided at the business meeting and welcomed the 75 members and guests present. Then introduced was the speaker, Dr. R. E. Savage, International Nickel Co. Inc., New York, whose subject was "Recent Developments in Ductile Iron."

In 1948, according to Dr. Savage, his company first transferred the work on ductile iron from its laboratories in New Jersey to several commercial foundries. Now there are more than 300 plants producing that material. Production has increased from 3500 tons in 1949 to an estimated 15,000 to 20,000 tons in 1950.

Some of the important features of

this new metal covered by Dr. Savage were: It can be cast in thinner sections because of its strength, and it is easily welded, can stand a good deal of shock, and has good machinability. Ductile iron, according to the speaker, has given the foundry industry a material to compete with weldments and forgings and has presented American industry with a new engineering material which will help in meeting material shortages and increased production requirements.—*James O. Ogden, Cleveland Tramrail Syracuse Co.*

Southern California

OCTOBER meeting of Southern California Chapter of the AFS was held at Rodger Young Auditorium, Los Angeles, Oct. 6. Speaker was Michael Bock II, metallurgical engineer, Exomet Inc., Conneaut, O.

Mr. Bock presented slides illustrating the mechanics of directional solidification in metals. He described top, parting line, and bottom gating, and explained the advantages and disadvantages of each with respect to feeding metal to the casting, to obtain clean, sound castings. Also shown were slides illustrating a step gate, strainer gate, horn gate and reverse horn gate. The speaker explained the advantages and disadvantages of each type gate with regard to metal feeding and casting cleanliness. Castings produced by centrifugal methods were compared in quality to parts produced by forging.

Mr. Bock described use of exothermic material on top of the riser metal to retard heat flow and to promote directional solidification. Maintaining temperature and insulation of the hot metal results in increased yield and a decrease in cleaning costs. As riser size is very important in obtaining sound casting, the speaker described how use of this material can increase yield by making possible a reduction in riser volume.—*S. L. Jackson, Electro Metallurgical Division.*

Canton

SEVENTY-FIVE members and guests were present at the initial meeting of the season of Canton District Chapter of the AFS held Oct. 5 at Mergus Restaurant, Canton. Thomas W. Harvey, chief engineer, Pittsburgh Valve & Fittings Division, Pitcairn Co., Barberton, O., and chapter chairman, presided. Vice Chairman C. B. Williams, Massillon Steel Castings Co., Massillon, O., introduced B. C. Yearley, National Malleable & Steel Castings Co., Cicero, Ill., the

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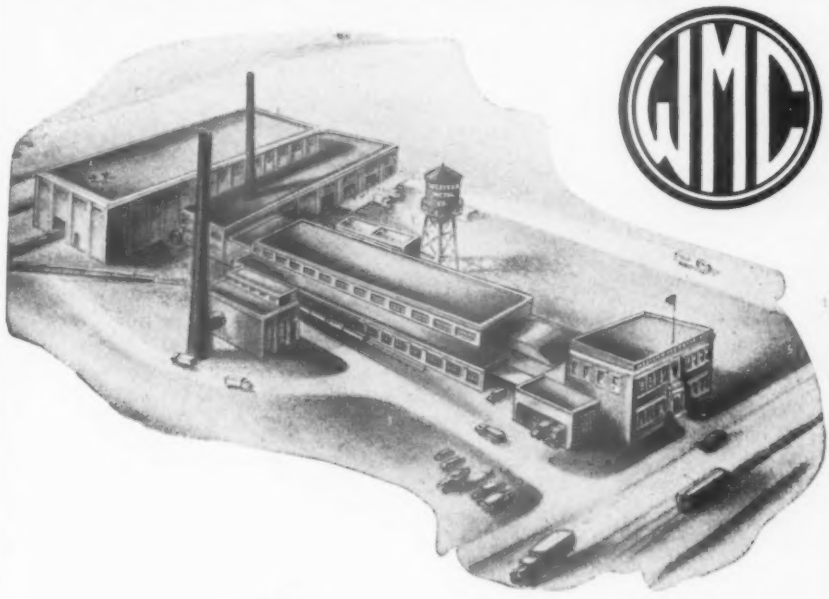

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CANTON DISTRICT Chapter of the AFS met at Mergus Restaurant, Canton, O., Oct. 5 to hear B. C. Yearley, National Malleable & Steel Castings Co., Cicero, Ill., speak. Shown above, left to right, are: H. G. Robertson, works manager, American Steel Foundries, Alliance, O., past chapter chairman; C. B. Williams, chief metallurgist, Massillon Steel Casting Co., Massillon, O., chapter vice chairman; Mr. Yearley, and Thomas W. Harvey, chief engineer, Pitcairn Co., Barberton, O., chapter chairman

featured speaker. His subject, "Causes of Hot Tears and Strain Cracks," brought out a number of practical applications that proved scientific or technological explanations.

According to the speaker, too much cannot be said on the expansion and contraction of molding and core sands and their relation to the cause of hot tears in castings. Often, he pointed out, improper gating and heading, especially when there are thick and thin cross sections in a casting, can cause difficulty because of the difference in expansion and contraction. One illustration was a sprocket with thin spokes and a heavy hub. He explained that much trouble was encountered when gated into the hub, but after gating on the thin spokes the trouble was corrected.—*Alexander Prentice, Stark Foundry Co.*

TEXAS CONFERENCE: Views of the first Texas Regional Foundry Conference, held at Plaza Hotel, San Antonio, Oct. 5-6. Registration was approximately 140

Connecticut Non-Ferrous

DEVELOPMENTS in core blowing were discussed by T. J. Magnuson, Champion Foundry & Machine Co., Chicago, at the Oct. 18 meeting of the Connecticut Nonferrous Foundrymen's Association held at the Castle Restaurant, East Haven, Conn.

In days past, most any kind of washed and dried silica sand was considered good enough for making cores. Today, foundrymen still use a variety of sands even to ordinary bank sand, but it has been found advisable to impose controls over the variables in coremaking if the efficiency demanded by today's competitive market is to be met. Use of blowers has made coremakers more control conscious since, with a blower, results can be achieved which cannot be duplicated on the bench.

Mr. Magnuson pointed out that the blower naturally picks up sand fines first and deposits them on the corebox walls, following with the coarser sand. This makes for a core that is more porous toward the center and gives a good natural vent. Care must be exercised, not to choose too fine a sand which will not provide natural venting. Other points considered were venting, blowholes, rigging, blowing pressures, pressures, prevention of fins and sticking.

In producing cores, actual blowing time is a small fraction of a second, the balance of the time being needed to effect removal of the core, etc. There now are production speeds of 3 to 4 seconds per cycle, but for this the operator needs guides and other aids for positioning. Large cores are being had in 10 to 12 seconds. Some companies find it feasible to run as many as 20 different jobs a day on a blower by standardizing roll-over heights, blower heights, etc.—*John V. McCarthy.*

National Carbon Division, Union Carbide & Carbon Corp., 30 East 42nd St., New York, plans expansion of its electrode plant at Columbia, Tenn., pending formal approval of arrangements with TVA for power supply. The proposed $5-million expansion is intended to meet growing demand for large graphite electrodes used in metallurgical industries.

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MANUFACTURE OF CAST STEEL ROLLS

By SAMUEL R. ROBINSON

THE difficult feature in manufacturing steel rolls is to capture the technique and experience of older men, and record the information so that it may be studied by younger men coming up in the industry. Older men were not technically trained. This is not meant in any way to disparage their ability and their truly wonderful accomplishments. They were close observers. Occasionally they might be at a loss to give a clear and logical reason for some of their practices; nevertheless, they got results and turned out good cast steel rolls. The reason for certain practices became apparent on close study.

For example, consider the subject of silicon. Suppose the specifications call for a carbon content of 1.75 to 1.85 per cent. If a charge is made up of low-phosphorus pig iron with silicon 1.50 to 2.00 per cent, about 30 per cent foundry scrap and the remainder purchased scrap, the silicon in the resulting bath will be so high that several hours' labor will be required to eliminate it. The silicon must be reduced before the carbon can be lowered.

The melting crew uses green wood poles and iron ore, but for a long time the bath is *dead,* showing no boil or action. Under similar conditions the old-time melter specified silicon under 1.00 per cent in the low-phosphorus pig iron, and the remainder of the charge rimmed, low-silicon plate scrap. This could be done in a plant operating a plate mill and where the metal was melted in basic open-hearth furnaces. In the adjoining steel foundry the metal was melted in two 30-ton, acid-lined, open-hearth furnaces. Excess foundry scrap was incorporated in the basic furnace charge.

With a silicon content of not over 0.50 per cent in the acid furnace roll heat, the silicon soon was eliminated. The bath early came to a good boil, and the carbon quickly dropped to the required point. The bath opened up to permit escape of hydrogen and other harmful gases, and the metal rose in the test mold. The residual silicon would be down to 0.03-0.045 per cent.

Every melter should be familiar with the harmful effects of a *dead* melt. He should know that silicon holds gases in solution. Until silicon is eliminated, the necessary boil will not take place. Eventually the occluded gases will cause trouble in the finished steel.

A few years ago there was a veritable epidemic of cast steel roll failures, mainly in the large alloy backup rolls in strip mills. Failure was due to concealed internal cracks. Examination of the exposed fractured surface showed fine, tough-grain metal in a complete ring around the circumference, and to a depth of 4 to 5 in. The entire central portion was coarse grained and weak. A small fraction of an inch away from the coarse, crystalline surface horizontally, the fracture again was fine grained. Furnace practice was responsible. When the heat was allowed to come to a strong boil, brought about by low residual silicon, the gases were eliminated while the metal was in a molten state. Apparently the internal rupture occurred just at the moment of solidification and due to liberation of gas. The gas was assumed to be hydrogen, but this has not been proved definitely.

Only an extremely limited number of steel foundries producing steel roll castings are in the fortunate position to make up a roll heat charge of low-phosphorus pig iron and low-silicon plate scrap. However, a low-silicon charge can be made by using some form of carbon for example, graphite, charcoal, petroleum coke, etc. instead of a portion of the pig iron. On a specification calling for carbon 1.80-2.00 per cent, manganese 1.70-1.80 per cent, chromium 1.05-1.10 per cent, silicon 0.25-0.30 per cent, the open-hearth charge might contain low-phosphorus pig iron 25 per cent, steel scrap 72.3 per cent, spiegel 2.7 per cent, graphite (70 per cent efficiency) 1.28 per cent. The log sheet for this heat would appear as shown in Table I.

One of the annoying defects in cast steel rolls is the presence of hard spots. They may be found in almost any part of the casting, frequently in the upper neck and in the passes. They are more prevalent in alloy than in plain carbon rolls. It is impossible to machine them. They must be ground out. The chrome-nickel-molybdenum alloy combinations frequently show hard spots. This form of defect may appear even where all alloys are added in to the

(*Continued on page* 190)

Table I—Log Sheet, Typical Heat

Charge: C 2.70, Si 1.50, Mn 1.15 per cent. Weight 37,000 lb. Began charge 3.15 a.m. Final charge 3.45 a.m. Level 7.15 a.m.
8.20 a.m.—C 2.19, Mn 0.38, Si 0.18. Slag thick-medium
8.50 a.m.—C 2.09. Slag thick-medium
9.18 a m —C 2.04. Slag thick-medium. One pole
9.42 a m —C 1.95. Slag thick-fair. One pole
10.08 a m —C 1.89, Mn 0.21, Si 0.08. Slag medium-fair.
10.35 a.m.—C 1.82. Slag FeO 16.15 per cent
11.03 a m —90 lb spiegel. 200 lb 15% ferro-silicon
11.13 a.m.—530 lb ferrochrome
11.28 a.m.—960 lb ferromanganese
11.46 a.m.—Begin tap. Temp 2770° F
11.48 a.m.—Finish tap. 20 lb Al in ladle
11.53 to 11.55 a.m.—Poured from No. 8 ladle into No. 3 ladle. Temp 2710° F
11.57 a.m.—Poured first roll. Temp 2660° F
12.03 p.m.—Poured second roll. Temp 2640° F
12.10 p.m.—Poured third roll. Temp 2610° F
Ladle No. 8, 3½-in. nozzle. Ladle No. 3, 2½-in. nozzle. Good swirl. Ladle skull clean.
Final analysis: C 1.78, Mn 1.54, Si 0.44, P 0.043, S 0.036, Cr 1.02

Table II—Recommended Pouring Temperatures

Carbon 0.60-0.70	2700 to 2730° F
Carbon 1.60-1.80	2620 to 2650° F
Carbon 2.00-2.10	2600 to 2620° F

Table III—Typical Annealing Cycle

22 rolls, total weight 137,000 lb

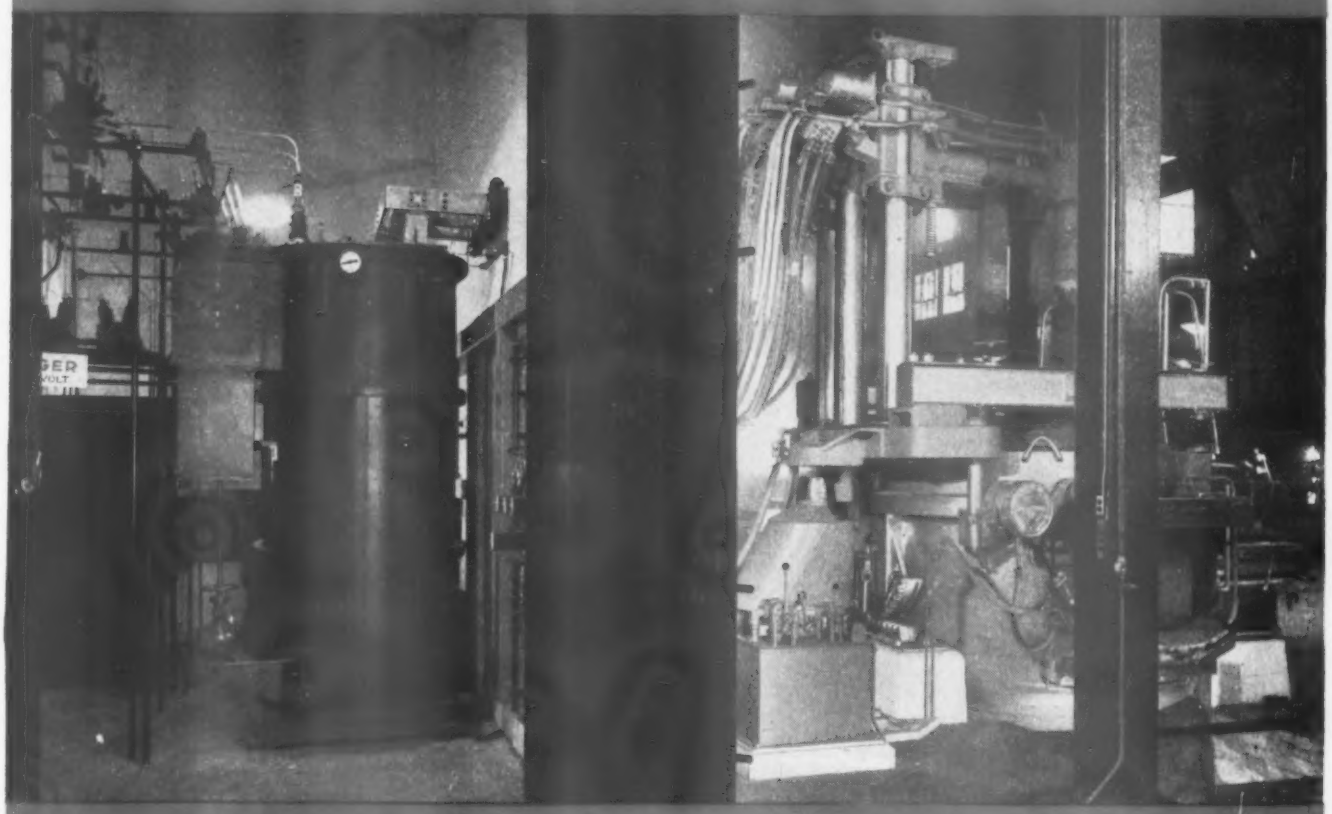
Heat to 1750° F	111 hours
Hold at 1750° F	38 hours
Cool to 600° F	38 hours
Heat to 1450° F	51 hours
Hold at 1450° F	30 hours
Total	268 hours

Table IV—Composition and Uses of Alloy Cast Steel Rolls

Analysis					
C	Mn	Cr	Ni	Mo	Where Used
2.20-2.25	1.75-1.80	1.05-1.10	.....	.....	Leader pass
2.05-2.10	1.75-1.80	1.05-1.10	.....	.....	Intermediate for angles and break down rolls
1.80-1.95	1.75-1.80	1.05-1.10	.....	.....	Finishing cleeves for tie plates
1.65-1.75	1.65-1.70	1.05-1.10	.....	.....	Billet and sheet bar roughers
1.55-1.65	1.50-1.60	1.05-1.10	.....	.....	Roughing rolls for flats
1.85-1.95	1.60-1.70	0.70-0.80	0.85-1.00	0.30-0.40	Leader pass for angles
1.40-1.50	1.40-1.50	1.05-1.10	.....	0.15-0.25	Roughing structural shapes
1.00-1.10	0.90-1.00	0.90-1.05	.....	0.30-0.40	Roughing for angles
1.30-1.45	0.80-0.90	0.90-1.05	.....	0.40-0.50	Intermediate piling bar
1.30-1.40	0.80-0.90	1.05-1.10	.....	0.20-0.25	Rougher structural shapes
1.35-1.45	1.35-1.45	1.05-1.10	.....	.....	Rougher structural shapes
1.00-1.15	0.90-1.00	0.90-1.10	.....	0.30-0.45	Rougher structural shapes
1.20-1.30	0.80-0.90	0.90-1.05	.....	0.35-0.45	Internal structural shapes
0.95-1.05	0.85-0.95	0.60-0.70	1.20-1.30	0.30-0.40	Internal structural shapes
0.85-0.95	0.75-0.90	0.90-1.00	0.90-1.20	0.20-0.25	Internal for Z piling
2.10-2.20	1.75-1.80	1.05-1.10	.....	0.40-0.50	Rail slitting roll
1.80-1.95	0.90-1.00	1.00-1.10	.....	0.40-0.50	Checkered plate roll
0.70-0.80	0.70-0.80	0.70-0.80	.....	0.35-0.45	Alloy bloomer
0.90-1.10	0.75-0.90	1.00-1.10	1.00-1.25	0.20-0.30	Alloy bloomer
0.90-1.00	0.70-0.80	0.60-0.70	1.50-1.75	0.50-0.60	Back-up roll

Phosphorus and sulphur 0.050 per cent maximum. Silicon 0.25-0.30 per cent

Not visible here is another Lectromelt Furnace; an old timer whose fine performance was responsible for the purchase of this new furnace.



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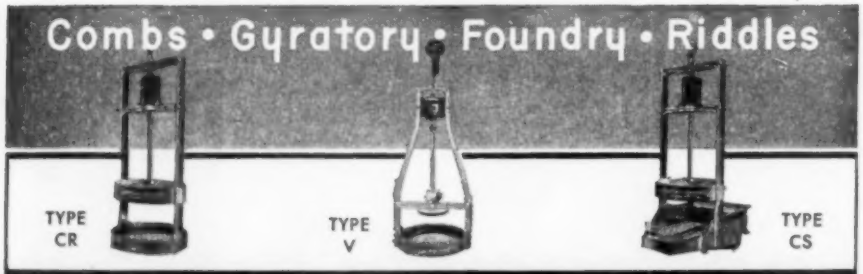


GREAT WESTERN MANUFACTURING CO.
LEAVENWORTH, KANSAS, U.S.A.

(*Continued from page* 188)

bath in the furnace. Where reladling is adopted there is much less tendency for hard spots to form. Another advantage of reladling is that it affords better control of the pouring temperature. Also the heat can be worked hotter, a feature which has several advantages.

Reladling is not particularly hazardous with bottom-pour ladles but it does require good ladle practice, with no leaky stoppers. Ladles should be thoroughly dried and hot. Good crane service is essential. Reladling should not be attempted where carbon content of the steel is under 1.00 per cent. Drop in temperature from tapping ladle to second ladle will be from 60 to 100 degrees. The same drop in temperature will occur between the second ladle and the mold. Recommended pouring temperatures for steels of varying carbon content are shown in Table II.

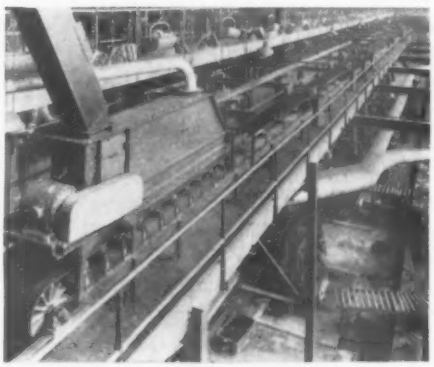
Chilling in cast steel roll practice consists in placing suitable pieces of metal in the sand mold. These pieces are sufficient in size and volume to extract heat from the molten metal faster than it would be extracted by sand contact. The molten metal does not come into direct contact with the chills, as in cast iron roll practice. The chill pieces are covered with sand to a depth of ½ to 1 in.

The mold for a cast steel grooved roll is swept horizontally in two half flasks. After the halves are dried, they are assembled, lifted into a vertical position and lowered into a suitable pit for convenience in pouring. The chill half rings, either cast iron or steel, are set in the passes and conform approximately to the finished roll contour. Hundreds of these half ring chills are stacked in the

(*Concluded on page* 192)

Above: Sand Plant in Large Gray Iron Foundry Showing Storage Bins, Weigh Hopper and Mill.

Belt Distributor Carrying Conditioned Sand to Molders' Hoppers.



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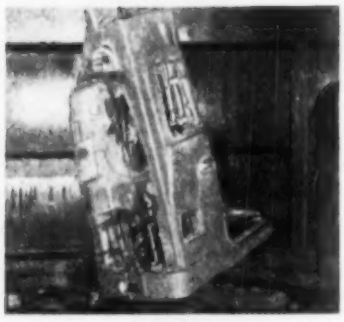
BLAST CLEANING and CORE REMOVAL

BEFORE



AFTER

PHOTOS OF SAME CASTING taken 15 minutes apart. One man removed core and blast cleaned with Pangborn Hydro-Sand Blast.

Pangborn Hydro-Sand Blast does the job . . .

IN ONE OPERATION Hydro-Sand Blast does a thorough job of both core knock-out and blast cleaning with high velocity sand and water. Core sand and rods are recovered without sledge damage.

WITH ONE OPERATOR Work rotates on table in self-contained steel plate room. One operator controls table and manipulates blast stream from outside. There's no dust or dirt.

WITH BETTER RESULTS Powerful blast stream cleans and cuts. The thoroughness and efficiency of this remarkable machine saves you time and money by cutting cleaning time and labor costs and making subsequent roughing and chipping operations faster, cheaper jobs.

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Look to Pangborn for the latest developments in Blast Cleaning and Dust Control Equipment

Pangborn

BLAST CLEANS CHEAPER with the right equipment for every job

(*Concluded from page* 190)

yard of a foundry engaged in the manufacture of cast steel rolls.

The use of chills is not upheld unanimously among rollmakers. Some old timers claim their use was brought about through lack of proper steelmaking knowledge on the furnace platform. In support of this claim the old timers state that in their day they made perfectly satisfactory steel rolls without the use of chills. The subject seems to offer an interesting field for further experimental work.

Heat treatment for an alloy steel roll that has given excellent service as a work roll in a strip mill is shown in Table III. The rolls in the rough were given this treatment. Then they were machined to within ¼-in. of the finished dimension. In a second heat treatment the rolls were heated to 1550° F and held for 18 hours, cooled in air under a man-cooler fan, drawn at 925° F for 12 hours and cooled in a furnace. Heat treating furnaces are available in several types.

Roll Gives Good Service

Composition of the rolls taking the foregoing heat treatment includes: C 1.40 to 1.50, Mn 0.90 to 1.10, Si 0.25, Cr 1.05 to 1.10, Ni 1.25 to 1.50, Mo 0.40 to 0.50. This type roll has given good service as a mechanical sheet mill breakdown roll; also as a back-up roll for a cluster cold mill.

The following comment is offered by way of review. Do not underrate the knowledge and ability of the old-time melter. He made good cast steel rolls long before modern technical methods were adopted. In melting a roll heat make sure the silicon is eliminated to a residual of 0.03-0.06 per cent. See that a vigorous boil is maintained for sufficient time to eliminate harmful gases. Reladle all heats of 1.00 per cent or higher carbon. Pour metal at correct temperature. In regard to the practice of chilling, see how far you can go in eliminating this feature. It has been estimated that chilling adds at least 30 per cent to the labor cost in making the roll mold. In addition, there is the cost of making, handling and storing the chills. Refractory quality of the molding sand should be high. The mold should be thoroughly baked.

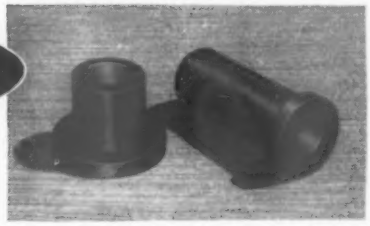
Advent of nodular cast iron and its use in cast iron rolls is expected to develop strong competition with cast steel rolls. If the steel foundry rollmaker is to improve his product to meet this competition, the obvious answer is research, research and still more research.

DO YOU OPERATE A CORE BLOWER?

THEN YOU NEED DURA LONGER WEARING PRODUCTS

Dura is a resilient plastic which gives longer service for blow tubes, wear inserts in core boxes and like applications. Chief advantages: it (1) outlasts metal 10 to 20 times; (2) resists oil, acid and alkalis; (3) is resilient, non-hardening, non-swelling; (4) can be cemented firmly to metal, and (5) can be replaced in the foundry without sending the core box to the pattern shop. The four Dura products mentioned below cost far less in use than the corresponding metal items. Write for our well illustrated 8-page Bulletin "A".

DURATUBES



Duratubes **pinch off sand tips,** eliminating distortion and hand filing of complex cores; cut production losses in the changing of bushings; seal effectively against air leakage between box and blow plate. They often cost less to buy than special metal tubes; they regularly stand up 10-20 times as long.

DURABUTTON

Durabutton is a plastic wear insert for core boxes which lowers replacement time and increases production; reduces wear on core boxes around wear inserts; sometimes makes fewer core boxes necessary; regularly lasts 10-20 times as long as metal inserts; quickly changed. Furnished with or without bolt.

DURASTRIP

Durastrip is a resilient, plastic sheet from which wear strips for core boxes or wear inserts of any shape can be cut readily. Its perfect fit forms a reliable air seal between box and blow plate, eliminating leakage and resultant wear; it is easily and quickly cemented into place; outwears metal 10-20 times.

DURAROD

Durarod is a resilient plastic rod, not tube, which seals the parting line of core boxes to prevent wear. It does away with blow-by *before it starts,* permitting the metal wear plate to function properly and wear indefinitely. No cement, no bother, no time lost, inasmuch as replacement is a matter of a few seconds.

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Metallic and Nonmetallic Coatings for Gray Iron

(*Continued from page* 79)

protecting ferrous metals since, even though the coating is incomplete, the iron base metal is protected from corrosion until the overlaying zinc and intermediate zinc-iron compounds are consumed. Since on ordinary exposure the zinc oxidic salts formed on corrosion are generally adherent and substantially impermeable, a marked increase in the useful life of a part normally results. Zinc coating (most often by the hot-dip process) is effective in increasing corrosion resistance of castings to ordinary and industrial atmospheres, salt air, and saline, alkaline and other corrosive water solutions. In fact, almost unlimited life often results in a particular application; for example, hospitals have reported galvanized gray iron tanks exposed to caustic sterilizing solutions as still giving good service after 27 years.

This immunity to corrosion has resulted in the galvanizing of a wide range of gray iron castings such as bridge parts, sumps, sewer gratings, dish washer parts, hot-water furnace parts, humidifiers, valve bodies, miscellaneous tanks, pipe fittings, refrigerator parts, sterilizers, pole line hardware, and a large variety of castings furnished the U. S. Government for use in exacting Navy or Army applications. Despite favorable service records, it is surprising, however, how limited is general knowledge of the possibilities of zinc-coated gray iron castings for replacement of comparatively high cost corrosion resistant materials.

If the galvanized part is exposed to humid or stagnant moisture conditions with limited access of oxygen, there is sometimes a tendency toward the formation of voluminous white corrosion deposits of zinc oxide instead of the usual hard adherent products. The white deposits are unsightly and may prevent proper functioning of parts requiring close tolerances. Immersion of the zinc-coated part in an acidified sodium chromate solution inhibits formation of such deposits (See ASTM B201-45T). This process[20] is the most common and is known as chromate passivation, although other proprietary processes such as the Iridite, Unichrome and most recently an electrolytic process can also be employed. Quite often, particularly in sea service, the zinc coating is painted, in which case chromating may be omitted and phosphating substituted as promoting better paint adherence to the zinc coating.

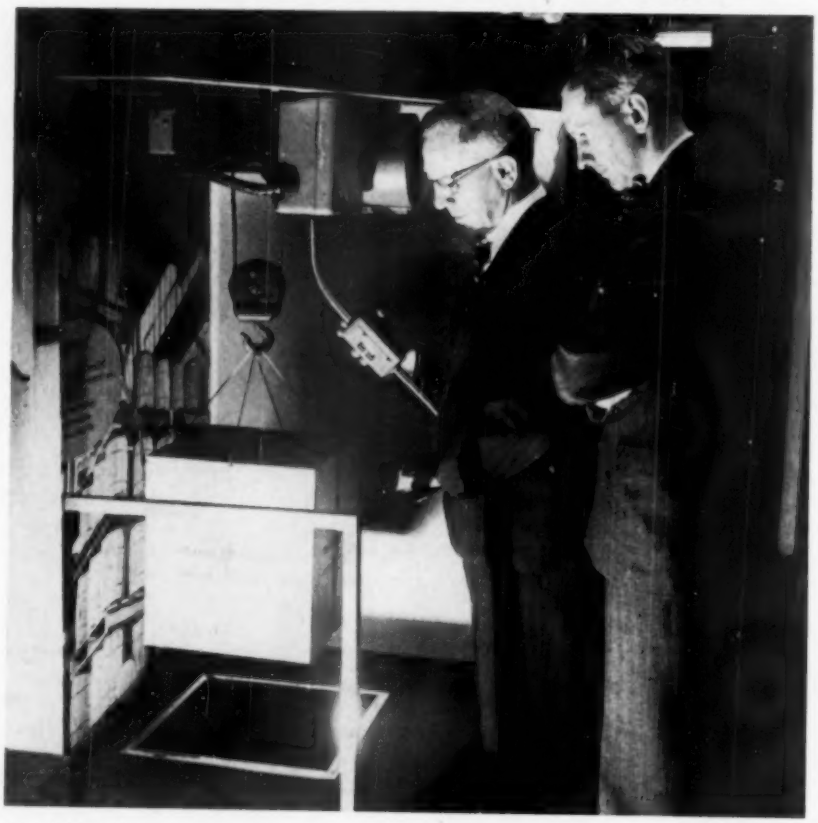
Surface Must Be Clean

Castings are either galvanized at the foundry or sent to a commercial galvanizing plant, the choice naturally depending on the quantity of castings to be regularly zinc coated and whether transportation charges are a large factor in the cost. The primary requirement in galvanizing is a clean surface, and a typical cleaning cycle consists in: (1) thorough sand blasting or tumbling since adhering sand will give dark spots. In cases where the casting is not or cannot be thoroughly sand-blasted, it is customary to pickle in 5 per cent hydrofluoric acid to dissolve adhering sand; (2) pickling at 140-180° F in dilute sulphuric acid (3-8 per cent concentration) and often followed by a dilute hydrochloric acid pickle; (3) rinsing; and (4) fluxing with fused ammonium and zinc chlorides held either in a separate container or floating on the surface of the molten zinc bath.

The cleaned casting is then immersed in the molten zinc bath. Some operators prefer 1 per cent lead in the zinc bath as giving a better appearing coat and less dross.[22] Small amounts of tin and aluminum are sometimes added to control spangle and brightness of the zinc coat. Time in the zinc bath is naturally dependent on the casting size, temperature of the bath, and weight of coating desired. It is common practice in the case of gray iron castings to specify an average of 1.8 oz of zinc per sq ft of casting surface (ASTM A152-47T). If a number of small castings

(*Continued on page* 196)

Exhibit Train Features Electrical Equipment



DISPLAY train, sponsored by General Electric Co., Schenectady, N. Y., and called the "More Power to America Special," consists of ten exhibit cars, containing a complete range of products for the production, distribution, and industrial utilization of electric power. It will visit approximately 150 industrial centers during 1950 and 1951.

Above, C. H. Lang (left), vice president in charge of sales, GE's apparatus, department, and C. P. Fisher Jr., manager of the apparatus exhibit train division, "spot" a dummy load in the materials handling section of the train. In this exhibit of small alternating and direct current hoist drives, a model hoist mechanism enables visitors to raise, lower, and "spot" a dummy load, using an actual pendent pull station.

One Source for Three Basic Materials for the Croning Process

If you are using or planning to use the economical, time-saving Croning Process for making foundry sand molds and cores—come to Bakelite for all three of these necessary materials . . . resin binders, wetting agent, and parting agent. Bakelite Division laboratories have formulated them specifically to fit the requirements of the Croning Process, and to assure the best possible results.

RESIN BINDERS

Three BAKELITE Phenolic Resins have been formulated for a wide range of suitability. They are QR-18554 (short flow), BR-18549 (medium flow), and QR-18659 (medium long flow). For general use, BR-18549 is recommended, but the other resins provide latitude in meeting specialized needs.

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To coat your sand for better adherence to the powdered BAKELITE Resins, BAKELITE Wetting Agent BK-11502 has been developed. Its use assures best results with the BAKELITE Phenolic Resin binders. Its availability greatly simplifies the purchasing of related products for the Croning Process.

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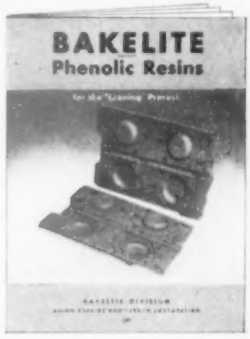

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(*Continued from page* 194)

are being handled, it is customary to spin or centrifuge them in a basket after galvanizing which throws off any excess zinc. This is followed by quenching in water to improve the luster of the galvanized coating. Control of the "pull-out" time is effective in yielding the desired coating weight on larger castings. Large castings of intricate shape are sometimes warmed by suspending them over the zinc bath to minimize thermal shock.

A high rate of dross formation (crystals of iron-zinc compound) in the molten zinc bath has been reported by some operators to accompany galvanizing gray iron and other castings. It will be found, however, that such drossing can be minimized by proper rinsing and fluxing to prevent the introduction of iron salts clinging to the castings and by proper control of the bath temperature, which should not exceed about 900° F. Improvements in galvanizing kettles also have been reported recently to reduce dross.[19, 23]

In addition to the galvanizing or hot dip method, which is by far the commonest, zinc coatings can be applied to gray iron castings by the metal spraying method previously described. Zinc can also be applied by sherardizing or by electroplating as will be described in the cementation and electroplating sections. The particular advantages of hot dip galvanizing are that this method is frequently the cheapest, good adherence can be obtained, galvanized containers are readily made water-tight, and heavy zinc layers are easily applied.

Lead and Lead-Tin—Lead coating of gray iron castings is of interest because, although low in cost, lead is more resistant to industrial atmospheres than zinc and has been found essential to resist corrosive conditions in certain chemical operations. The temperature of molten lead baths used for coating are also low, normally less than 700° F, minimizing thermal shock and distortion. Despite these facts there has been only a limited application of high lead coatings to gray iron or to steel[24] for somewhat the same reasons, namely: (1) pure lead does not form a close bond with iron (lack of intermetallic compounds); (2) there is a tendency toward pinhole formation; (3) lead is soft and its resistance to wear and abrasion is low; (4) there is a tendency to form unsightly corrosion products; and (5) lead is slightly cathodic to iron so that if the coating is not complete, corrosion may occur at

(*Continued on page* 198)

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(*Continued from page* 196)

the expense of the underlying iron.

Some of the adherence difficulties can be overcome by use of a lead bath containing up to 2.5 per cent tin and 2.0 per cent antimony. An alloy with about 0.55 per cent Zn has been used. Such lead alloys are commonly held at bath temperatures of under 650° F. The hot dip lead-alloy coating thickness on hardware specified by ASTM A267-46T varies from 0.15 to 0.51 oz per sq ft (.00016 to .00053-inch thick) depending on the size of the article and whether it is centrifuged. Some authorities feel that, because of the low wear resistance of lead, heavier coatings of the order of 0.003 to 0.005-in. are desirable—at least if lead is electroplated or sprayed. Use of higher tin-lead coatings, (15-25 per cent tin), usually referred to as terne plate, is, of course, a possibility if corrosive conditions permit. As tin alloys with both cast iron and lead, it is effective in bonding the high lead coating to the base metal. Zinc, cadmium and mercury have also been suggested as alloys to promote the adhesion of lead coatings[27].

Although no specific or rigid instructions are apparently available for preparation of gray iron castings for lead coating by dipping, it would appear that a decarburizing treatment with fused nitrate salts or the Kolene process described previously is a desirable preparatory step.

Lead-coated gray iron castings should be excellently suited for use where high resistance to corrosive atmospheres is the prime necessity, and wear resistance is not required. Such uses would be pole-line hardware, gasoline tanks, electrical hardware, outside building materials, washers, certain farm and military equipment, etc. Lead is also resistant to sulphuric and sulphurous acid fumes, and as a coating would be expected both to resist these chemicals in dilute solution and supplement the tendency of the underlying gray iron to resist concentrated sulphuric acid. One of the definite advantages of lead-coated materials is that paints adhere more easily than to most other metallic coatings and lead-coated castings can be painted without weathering[25].

Aluminum (Aluminizing)—Significant improvements in methods of aluminum coating gray iron by hot-dipping have recently been realized. Hot-dipped aluminum coatings are valuable in enhancing resistance of gray iron to both corrosion and high temperatures. Although, like zinc, aluminum coatings should theoretically be consumed or sacrificed while protecting the base metal from corrosion, early formation of adherent, low activity aluminum oxide films on the coating surfaces renders protection of the base metal less effective unless the coating is continuous. This makes it particularly desirable to have good adherence or an iron-aluminum layer between the base metal and coating, such as is formed in hot-dipping. Under such circumstances excellent resistance to the atmosphere, liquids, concentrated nitric acid, etc. has been reported[28].

As regards oxidation resistance, aluminum alloying with iron to form an adherent coat greatly increases the resistance of the casting to very high temperatures and practically eliminates scaling at temperatures up to approximately 900° C (1650° F). In fact, service tests have been so satisfactory that plans are now under way to commercially adopt manifolds of gray iron treated by hot-dipping in aluminum. Such aluminum-coated castings are of potential value as oven linings, muffles, furnace parts in general, heat reflectors, heating element holders, and all applications where resistance to scaling or maintaining a heat reflecting surface is desirable. It is of interest that when unusually thick coatings are desired hot-dipped pieces can be used in a variation of the calorizing process in which dipped pieces are heated to promote further alloying of the coating with the base iron.

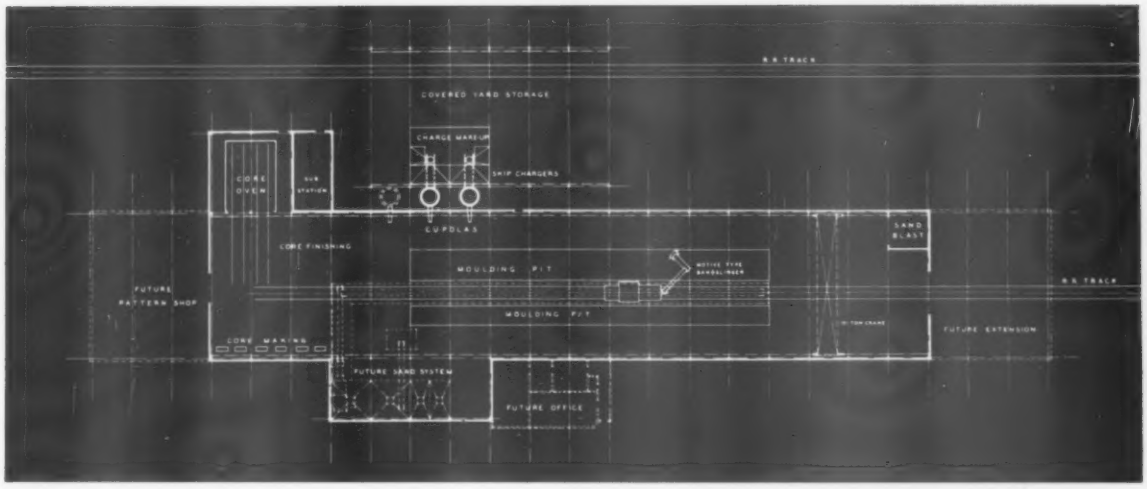
Remove the Graphite

The hot-dipping process in most common use involves removal of graphite from the gray iron surface by proprietary treatments such as the Kolene method or use of fused nitrate or chloride salts, as described in the section on tinning. After this cleaning the casting is dipped for a few seconds in a proprietary flux held in the temperature range 750-825° F. It is finally immersed in a bath of molten aluminum kept at a temperature of 1250°-1300° F. In this process the final aluminum or aluminum alloy bath is superimposed or floating on the surface of molten salts consisting chiefly of barium chloride[28, 29]. An outer coating of aluminum 0.001-in. thick is readily obtained coupled with an intermediate iron-aluminum layer of approximately equal thickness. It is customary to specify an aluminum weight of 0.50 oz per sq ft (which for the same thickness compares to about 1.3 oz per sq ft of zinc).

Two older hot-dipped processes[31, 33] exist, and should probably be mentioned. One involves removal of oxide from gray iron by pickling, heating in a reducing atmosphere or, in the case of the Nillson process[31], heating in a liquid flux (10 per cent cryolite, 20 per cent zinc chloride, 30 per cent sodium chloride, 40 per cent $CaCl_2$), followed by immersion in molten aluminum at a temperature of 1300° F. The second process, which reportedly produces adherent aluminum coats, involves use of thin undercoatings of tin, zinc or cad-

(*Continued on page* 202)

SCHOLARSHIP WINNERS: University of Wisconsin recently awarded Foundry Educational Foundation grants to the students shown above. Front row, left to right, are: Richard Williams, Richard Haffeman, William Schrader, Emil M. Punko, Gerald Tannenbaum, Eugene Adamczyk, William Tetzlaff, George Stein, Donald Benn, Arthur H. Zrimsek, and Richard Sievert. Back row, left to right, are: Richard Simonovich, Walter V. Green, Walter Jahnke, Frank Lisi, Carl Schoettler, Carl E. Menning, Frank Szczesny, Grant Thomas, Robert Rittman, John Losse, and William Gloe. Other winners not in the photo are Robert Roloff and Nick Taktokopoulos. Each of these students has spent at least one summer in foundry work and a few worked in foundries prior to attendance at the university



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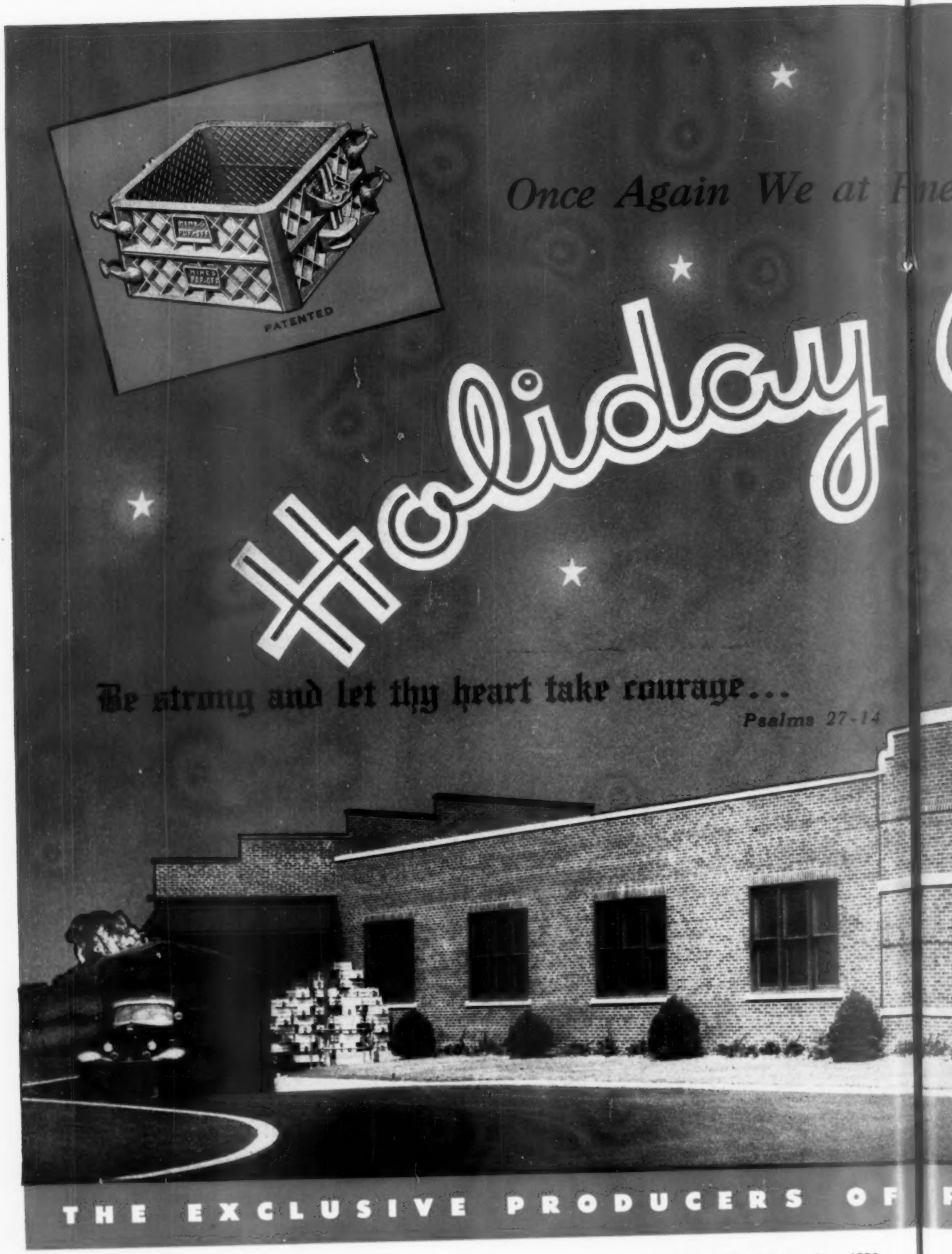
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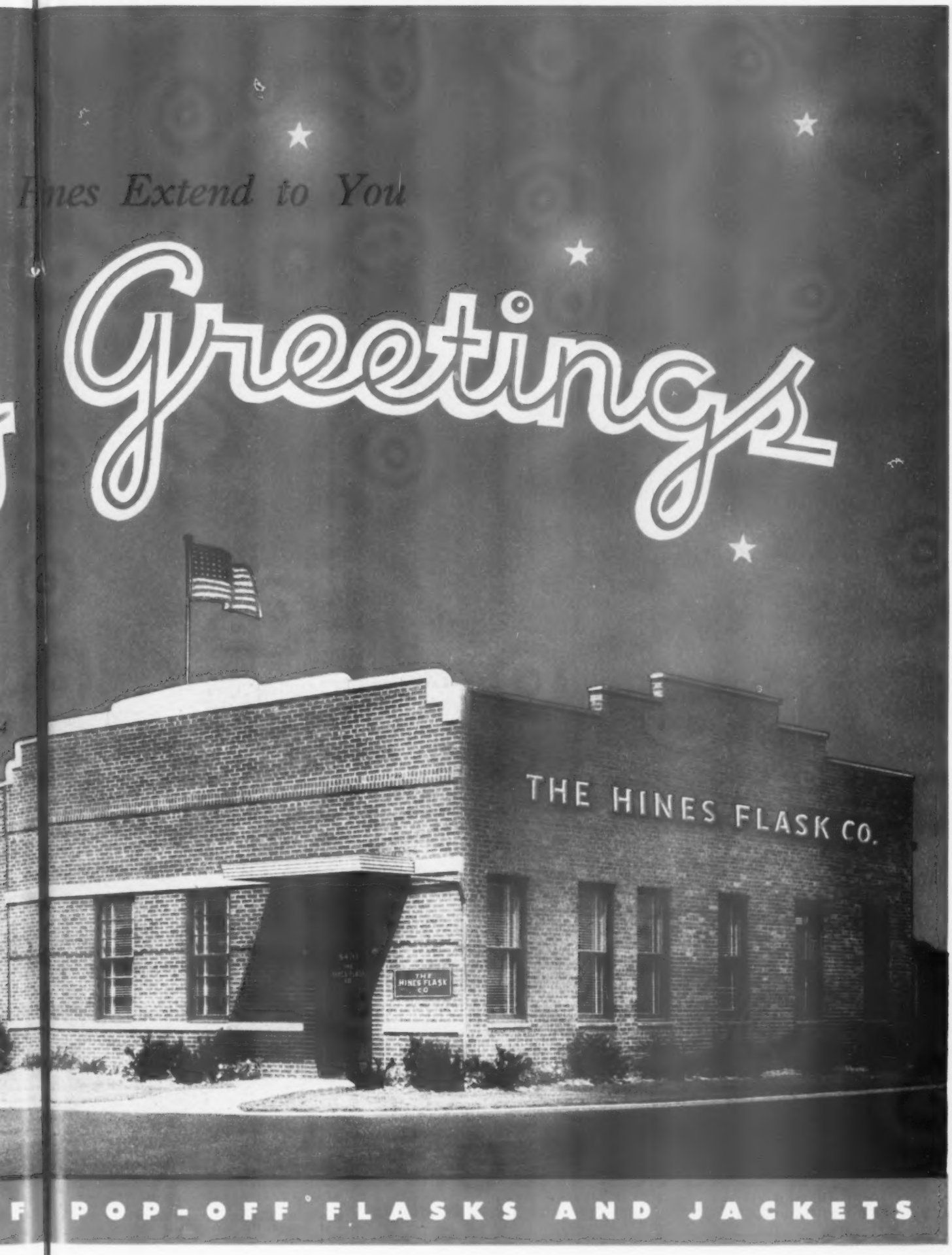
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(*Continued from page* 198)

mium (servarizing) before immersing in the molten aluminum. It is not known if any wide commercial application has been made of these two processes.

Since development of the simplified aluminum coating process for gray iron described first, active interest has been shown in expanding uses for coated castings. Possible fields, in addition to manifolds, include protection of brake drums from corrosion, and use of duplex wheels consisting partly of stampings and aluminum-coated castings. It is believed that the light aluminum coat produced on gray iron by hot-dipping will facilitate later production of gray iron and partly of aluminum.

(*To be continued next month*)

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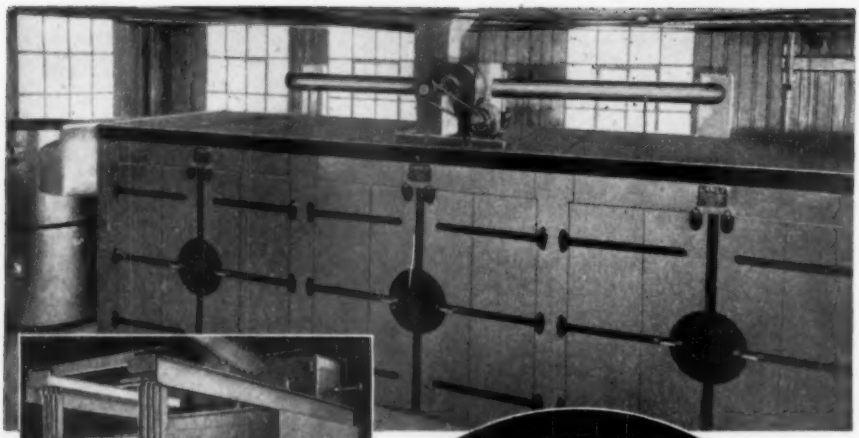

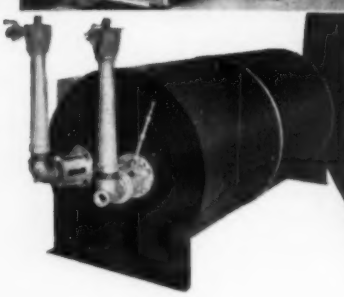

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Sources of Illustrations

Fig. 1—Cooper-Bessemer Corp., Grove City, Pa.
Figs. 2, 3—Thornton Co., Cleveland.
Fig. 4—Kolene Corp., Detroit.
Fig. 5—Tin Research Institute, Middlesex, England

Comparative Growth of Gray Iron—Nodular Iron

(*Continued from page* 99)

and one at the center, are shown for the heat-treated samples.

The outer rim or edge of all the gray iron samples showed complete graphitization of the matrix. The large dark areas shown in samples Nos. 1 and 2 are graphite. On visual examination of these samples it was noted that there were areas enveloped by graphite which contained appreciable amounts of FeO and MnO. This condition can be seen most clearly on sample No. 3. Therefore, even when precautions were taken to avoid oxidation they were not sufficient to completely avoid it. However, we do not believe that the growth experienced can be attributed only to oxide penetration but rather to a combination of graphitization and oxide penetration. The center part of the samples shows complete graphitization for Sample 1 and partial graphitization for Samples 2, 3 and 4.

The effect of the heat-treating cycle on the nodular iron is completely different than that obtained on the gray iron. There has been a partial graphitization of the as-cast material and a re-solution of the carbon in the annealed material, one in the as-cast and the other in the annealed condition, shows that the as-cast material partially graph-

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itized and the annealed material effected a re-solution of the carbon so that they both became stabilized at approximately the same combined carbon content. In the case of Sample 6 there has been a complete re-solution of the carbon during the heat treatment. This is confirmed by measurement of growth of the annealed specimen during this same time. Those measurements also show that there was little or no growth after this initial period.

The nodular iron samples also showed a ring of oxide penetration which was much thinner than that obtained on the gray iron ones. Microexamination of this ring shows a lower combined carbon than the center which we believe is ample proof of oxide penetration.

Draws Conclusions

It can be concluded from the results of this experimental work that:

1. Nodular iron when cyclically heated into the austenitic range and cooled shows much less growth than gray iron. The iron becomes rather stable after the first initial small amount experienced.

2. The growth of gray iron is considerable when given the same heat treatment and is dependent on the carbon equivalent of the iron and whether it contains any carbide stabilizing alloys such as chromium. Graphitizing elements apparently do not prohibit growth if they are present in insufficient quantities to keep the matrix austenitic.

3. Growth in heating is due to a combination of two things—oxide penetration and graphitization.

4. Oxide penetration is helped when the graphite is in the flake form and resisted when it is in the nodular form.

5. The cyclic heat-treatment given is very detrimental to the physical properties of gray iron unless stabilized with a carbide stabilizer. On the other hand, the same heat treatment increases the tensile strength of the nodular iron but lowers the ductility as indicated by the elongation.

Reference

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R-S Products Corp., 4530 Germantown Ave., Philadelphia, has been awarded contract to design and construct a continuous cast iron pipe annealing furnace for U. S. Pipe & Foundry Co.'s new western plant in the San Francisco Bay area. The foundry will make centrifugally cast pressure pipe.

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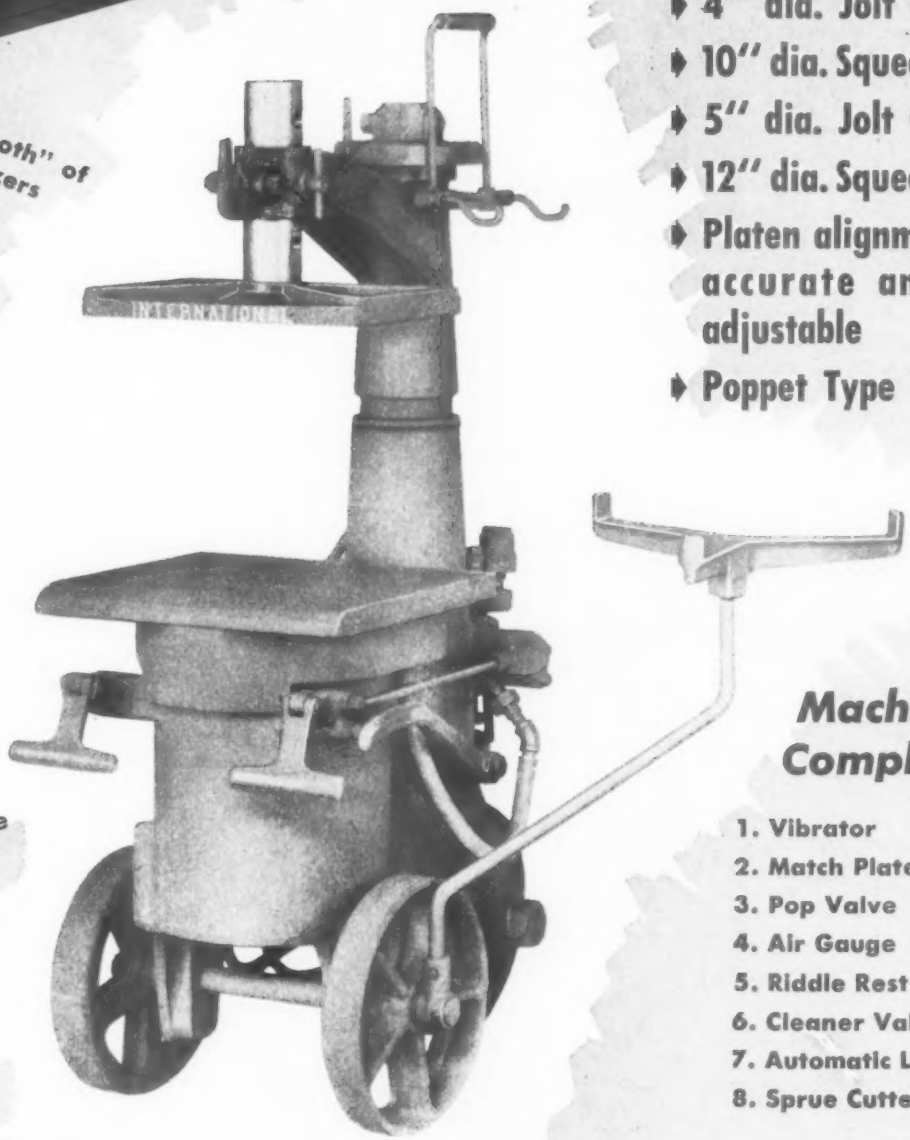

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By PAT DWYER
Drawings by RICHEY

EVERY once in a while," I said to Bill, "when I have nothing else to do and the old mental engine is just turning over, I wonder how the foundry business will carry on during the next fifty years, or any other convenient period you care to select."

"Well," he admitted judicially, "the first answer that comes to mind is: What do you care? You won't be here. Like the lads in the well known and melodious Whiffenpoof song, you will be gone and forgotten like the rest. If you want my candid and absolutely free opinion, a man under present conditions has his hands full attempting to keep a hop or two ahead of the old clothes man, the sheriff and you-know-who with the horns, the cloven hoofs, the forked tail and the red-hot pitchfork, without worrying over times and conditions he never will see. I don't think you have any justification for going into a tail spin or of losing any sleep over the future of the foundry. It is one of the oldest, if not actually the oldest, of the mechanical arts. It has survived floods, fires, migration and the combined assaults of the Four Horsemen of the Apocalypse, and is in better condition today than at any period in its long history."

"Certainly a remarkable record. Adopting the technique of the professional interviewer who presents impudent and other questions to all and sundry, I might ask, to what do you ascribe the virility of the foundry industry?"

"Ah, me boy!" Bill assumed the typical attitude and the deep chest tones of Senator Claghorn. "I could give you a very handsome list of reasons to account for the continued lively existence of the foundry industry. However, since you appear ready to take off at a moment's notice, or in half a moment, I shall mention just one, to wit, viz & so forth: The amazing vitality, virility and physical perfection of the foundry personnel. Tough, hardy lads every one of 'em. According to a popular foundry tradition, they never die. They root away in the sand for an incredible number of years and then just vanish!"

"That line of talk reminds me of the colored gentleman who went to a cemetery one night. To increase his luck with the bones and other methods of improving his financial standing, he proposed getting a rabbit foot to carry in a hip pocket. Every person over the age of seven knows that for maximum efficiency, the left hind foot of a rabbit must be acquired in a cemetery at midnight and in the dark of the moon. Crouched down by a tombstone he read the inscription by a random flash of moonlight: 'Johnny Holtott, not dead but sleeping.' The rabbit hunter shook his head. 'Dat Johnny boy,' he muttered, 'shuah ain't foolin' nobody but hisself.' "

Pulling two imaginary guns from imaginary holsters on either hip and leveling them in my general direction, Bill inquired in his best dramatic manner "MEANIN' ?"

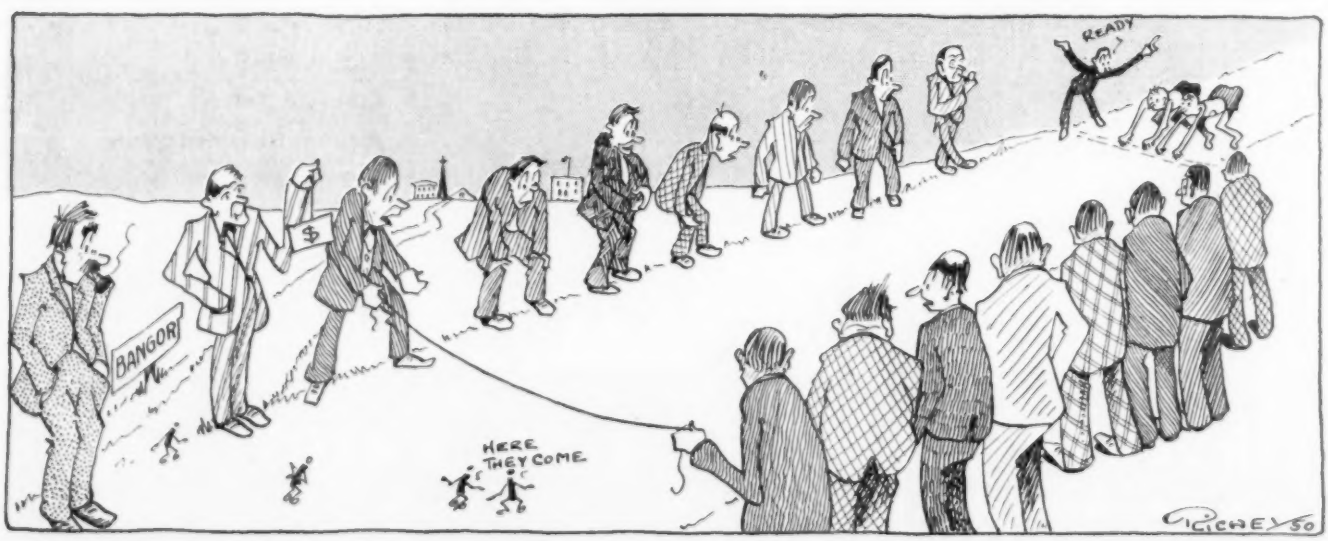
"Possibly," I said, "I may be flattering you, but I believe with a little effort you may be able to read the parable."

Bill holstered the guns and dismissed the cruel statement with a careless gesture.

"I can read other kinds of stuff too, if you really want to know. For instance that line of dope I handed you about the foundry industry and its personnel was prompted by an item I saw the other day while taking a leisurely gander through an old volume of THE FOUNDRY.

"Ever on the alert for items of interest to the foundry industry, plants, equipment, methods and employees, the editor cribbed an item from a Maine newspaper and reproduced it in the October, 1899 issue of THE FOUNDRY. If for no other reason, the item is interesting in that it shows what a hardy crew manned the foundries in those days. They never knew fatigue. They shoveled and pounded sand 10 to 12 hours a day. Carried off and poured vast quantities of iron. Engaged in weight lifting contests, putting the shot, throwing the hammer, baseball, football, cricket and marvelous maneuvers on the hanging rings and the horizontal bars

(*Continued on page* 208)



The boys love to indulge in a little gentle exercise after pouring off a two-hour heat in the foundry

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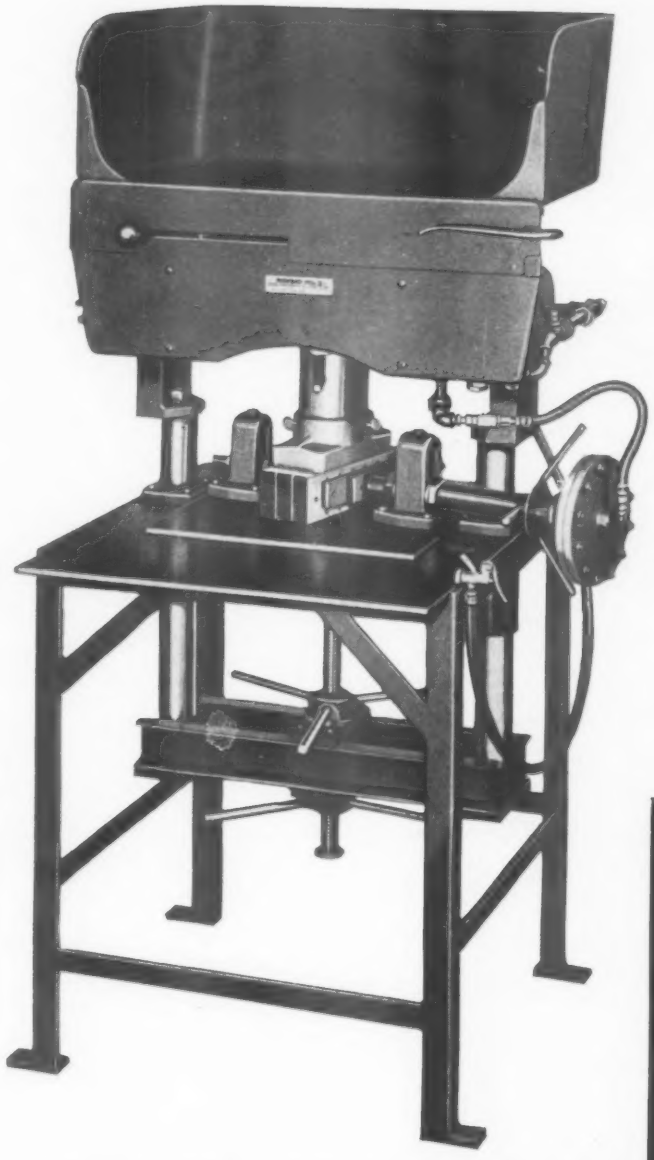

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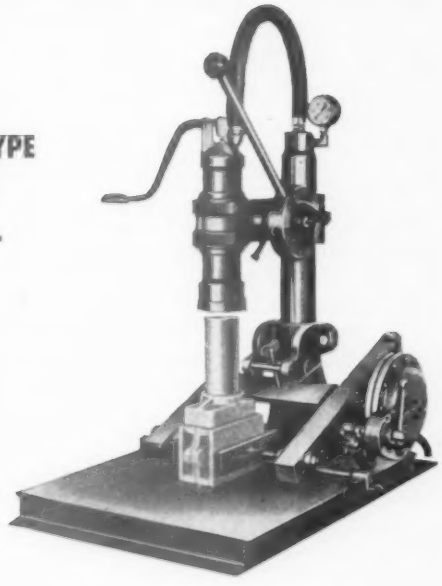

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(*Continued from page* 206)

for a few hours after supper and then danced for the remainder of the night. 'Ehyah,' my old aunt Jemima sighs occasionally, 'They wor great min in thim days.' "

"Never mind the long-winded panegyric," I interrupted. "Clean the rust and the crusted sand off your shovel and get along with the work."

"I made a copy of this literary gem which now I shall be happy to read if you will kindly shut your trap and signify applause by a gentle clap."

Jas. W. Cratty and Rufus R. Morrison, molders in the Noyes and Nutter's foundry, Bangor, Maine, recently ran a foot race in which Cratty made a record that set the professional championship bee a-buzzin' in his bonnet. According to all reports the first heat was phenomenal. Both sprinters reached the tape in just 17 seconds by several reliable stop watches. The published account does not state how far the tape was from the starting place but it is quite reasonable to assume that the entire race course was within the official boundaries of the state of Maine. And mind you that is quite a hitch from Madawaska to Kittery, and the Portsmouth Navy Yard.

The *Commercial* from which we take the report says that they ran 100 dashes. We are inclined to the opinion that this is a missprint. The hurried reporter probably meant to say that the athletes ran 100 rods, or yards or feet or something of that kind. It is hardly possible to assume that even these iron men dashed the full distance, whatever it was, 100 times. The special inducement to the participants was a purse amounting to, all told, one ($1.00) dollar, made up by a group of public-spirited men of Bangor, the full amount without entrance fees or other deductions to go to the winner of the race. A vile and insidious rumor to the effect that a portion of the money was contributed by outsiders was repudiated with unanimous scorn.

Some of Mr. Morrison's friends are highly dissatisfied with the outcome of the event, believing as they do that he is capable of acquitting himself much more favorably than he did on this occasion. Up to the present there has been heard no hint of race track doping or other dirty work at the cross roads, but—well—we shall see. We shall see.

Already there is some scattered small talk of an endeavor to raise another purse. Several prominent citizens hold that this is like looking a gift horse in the mouth, expecting the community to go down into its pocket for another dollar, cash money. A timid suggestion has been offered that the next purse be at least a dollar and twenty five cents ($1.25), the twenty five cents to go to the loser. This really is going too far, proposing to hold up an entire community before it has had time to recover from the effects of the first hold-up party.

Doc Billswaggle, our local and well known man about town pooh-poohs this latest idea. On more than one occasion, when properly fortified, he has been heard to declare boldly they ain't nothin' small 'bout Bangor. If and when it comes to a show-down he'll head the list hisself with a ten-cent (one dime) donation. So another race probably will be pulled off at an early future date.

"Since all these hardy, hairy, fleet-footed athletes long ago have quit the foundry for the Halls of Valhalla, it is idle to speculate on the result, if any, of a heavily financed second race. Therefore, dear brethern, let us concentrate on present day affairs. Anything new in your correspondence with the boys on the firing line?"

"Well," Bill said, "the answer is yes and no. I had a new inquiry recently on an old problem. Here, I'll read it.

For several years we have had no trouble getting hot iron on the first tap from the cupola. Recently since the cupola was relined to 32 in., inside diameter, the iron comes cold on the first tap, and sometimes on the second tap. We have to use a sledge hammer and long pointed bar to open the tap hole. We use dry wood for kindling. Light up at 12:30 p.m. and start the blower at 2:30 p.m. We have first iron in 12 to 15 minutes.

"To this I replied as follows:

"The fact that the cupola lining

(*Continued on page* 210)

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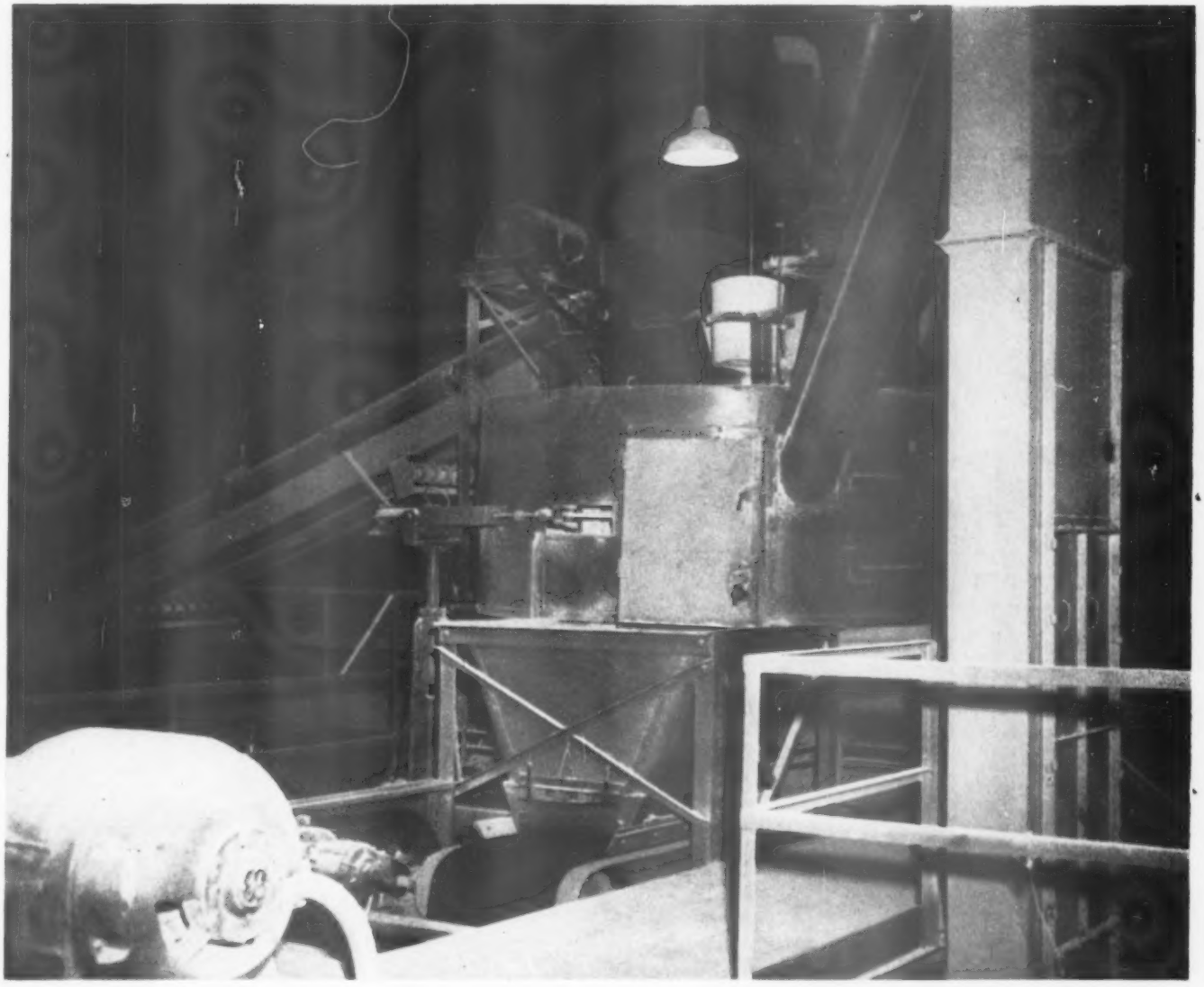

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(*Continued from page* 208)

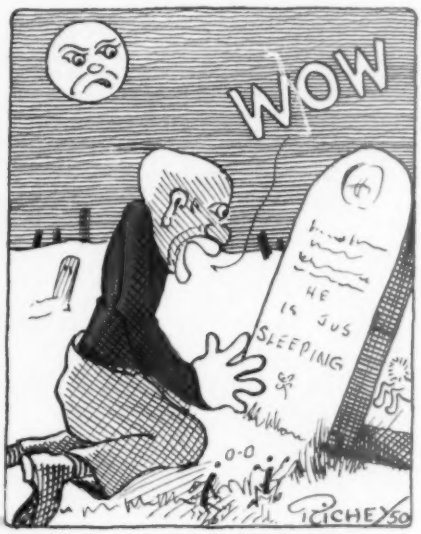
presumably has been reduced in diameter is not responsible for cold iron on the first and second tap. Hot iron can be produced as readily from a small as from a large cupola. Although your practice apparently is the same as under former conditions, the result seems to indicate that there is a slip-up in one or more of the factors involved in the sequence of production. Your statement that the first iron appears in from 12 to 15 minutes suggests a natural question. Assuming that the tap hole is left open, does your statement mean that the first few drops appear in 12 to 15 minutes or does the statement mean that you tap the cupola for the first time 12 to 15 minutes after the first few drops appear, or, 12 to 15 minutes after the blower is started? Any diagnosis of the problem depends to a considerable extent on this feature.

"If the first few drops are driven from the tap hole in 12 to 15 minutes, the bed is too high. If the first iron is tapped in 12 to 15 minutes the bed is too low. In either case the metal will be cold. The point readily may be discovered by a little experimental change in the height of the bed.

"The usual cause of cold iron at the beginning of the heat is a wet, hard or cold sand bottom. Needless to say the bed sand should be dry and hot before the first iron comes down. In some instances the cupola man, with good intention but faulty judgment, sloshes clay wash on the bottom doors and around the joint. Also, he leans too heavily on the rammer. The treatment produces a good tight bottom and prevents leaks. Unfortunately the molten iron does not lie on it quietly. Steam causes the metal to boil with resulting loss in temperature and a considerable change in the composition of the metal.

"At one time foundrymen held to the belief that the first iron from the cupola was only fit to be poured in a pig bed. The amount varied from 100 to 300 or 400 lb depending on the size of the cupola. Tradition and custom are responsible for observance of the same practice in a number of foundries today. Hard and cold first iron from a wet sand bed should be poured in a pig bed or into iron molds, but this waste of iron is not necessary. It is eliminated where the bed is prepared properly.

"The practice of blowing through an open tap hole until the first iron commences to dribble through is a relic of old-time rule-of-thumb cupola practice. One of the alleged advantages is that the flame, sparks and hot air heat the breast and tap hole, and to a certain extent the spout in the vicinity. Modern practice does not recognize the advantage and does not favor this messy method. Where a refractory tapping block is not employed, the breast is dried satisfactorily by the fire on the inside. The



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spout is dried with a torch or with a small wood or charcoal fire.

"Tap hole and tuyeres are left open until the coke bed has burned through, usually a short time before the blower is started. Then the tuyere lids are closed. A 5 or 6 in. piece of stock core is inserted in the tap hole, flush on the outside and projecting 3 or 4 in. on the inside. Where the core is a loose fit, the outer end is daubed with clay. This core easily is removed when the time comes to tap the cupola. Hard clay bods are an abomination. The clay should be mixed with a small quantity of burned sand, coal dust, or sawdust, readily removed to leave a clean, smooth tap hole.

"For a complete description of the cupola, care, operation and control we suggest a study of *The Cupola Handbook*, sponsored and issued by the American Foundrymen's Society. The information has been compiled by a group of expert foundrymen and reflects modern practice.

Open Hearth Group Discusses Research

Directors and research staff of the Acid Open Hearth Research Association, Pittsburgh, held their first fall meeting Oct. 10 at the Roosevelt Hotel, Pittsburgh. Research progress was discussed in detail by members of the research staff. Recent accomplishments of the staff include the development of a Pt-PtRh immersion thermocouple for acid open hearth use; the development of a method for determining metal fluidity and a method for determining oxygen in steel. The latter procedure is similar to the carbon combustion method. Considerable advances made have contributed both to the quality of the product and to the rate of production in acid open-hearth furnaces.

Also considered were methods for extending membership to permit some of the smaller companies producing acid open-hearth steel to become members on a more equitable basis. A program whereby the annual research stipend would be charged on the basis of steel produced was considered. Sufficient reserve funds are available to permit continued research for several years.

The association is comprised of 12 steel companies and 15 plants which manufacture steel by the acid open-hearth process and have been co-operating on the research program for eight years. Any company having furnaces of this type may become a member of the association. Six meetings of the technical and executive groups are held each year.

Nickel-Alloyed Brass and Bronze Bearing Metals

(*Continued from page* 83)

a soft metal cushion possessing conformability, embedability and good bearing metal quality under conditions of distortion, dimensional instability, uncertain lubrication, etc. They are mechanically weak at room temperatures and lose strength further when heated. Small amounts of nickel, of the order of 1.0 per cent, may be used as a "hardener," reinforcing both the tin base and lead base types. An example for which it is claimed that the softening temperature is raised from 180°C to 200°C by the presence of 1 per cent nickel consists of: Antimony 15 per cent, lead 75 per cent, tin 6 per cent, arsenic 1.0 per cent, nickel 1.0 per cent, phosphorus 0.40 per cent, cadmium 1.5 per cent.

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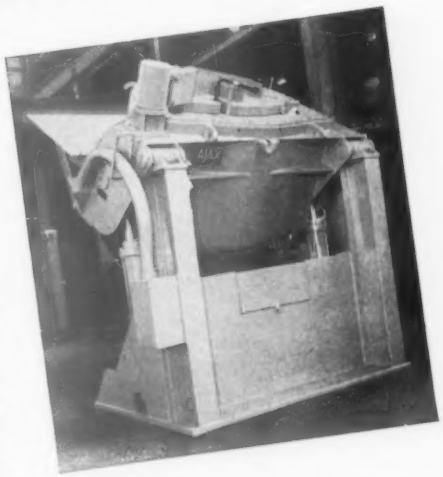

Photo shows furnace with melting capacity of 1,800 lbs. of aluminum per hour. Holding capacity is 8,000 lbs. Rated 330 KW. Furnace has hydraulic tilting device.

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sional stability are difficult to control. Composite bearings consisting of a babbitt surface backed by bronze or steel or both, are also in extensive use, although they may not, strictly speaking, be foundry products. Composite or "backed bearings" may be surfaced with nickel-alloyed materials of the lead, tin or cadmium types of babbitt; also with aluminum alloy, as shown in Table VIII, as well as with the leaded bronzes.

In addition to composite metal bearings of the type described above, a specially procesed type employs powdered nickel and copper in its production. This bearing is based upon a steel back, over which a 60-40 mixture of copper-nickel powder is sprinkled and sintered into position, after which an overlay of lead base babbitt is applied for a thickness not exceeding .003-in. Many bearings of this type are employed in automotive work for connecting rod and main bearings as well as camshaft bushings, etc. The copper-nickel sinter provides a compatible bonding alloy with the steel surface, while the porous copper-nickel sintered sponge provides an excellent anchorage for the babbitt subsequently deposited to form the bearing metal surface. Bearings of this type are rated to carry 15 to 20 per cent more load than the conventional lead-base babbitts.

Many special products containing nickel as an alloying ingredient contend for a position as bearing materials. The powdered metals and alloys represent a typical group. Nickel-alloyed powders, except for their peculiar structural condition, behave metallurgically much like their cast metal companions.

Solid aluminum base bearings of a composition similar to that shown in Table VIII are in commercial use in the smaller sizes of diesel engines, and experimental work has indicated promise for them in the diesels of the railroad locomotive size.

In special applications in which the factors of heat or corrosion dominate the application, bearings may be made in iron base alloys of the Ni-Resist type, nickel-alloyed aluminum bronzes, silicon-alloyed copper and copper-nickel base compositions, such as "S" Monel and "H" Monel, and also in the nickel-base compositions alloyed with carbon, tin or similar elements which contribute to bearing metal properties.

Foundry practice for the bearing bronzes does not differ significantly from the usual methods of melting, molding and pouring other bronze castings. Impurities such as silicon, iron, and occasionally magnesium or aluminum, must be limited to harmless amounts. Phosphorous in excess is reputed to encourage pinholing, and organic binders in the sand may lead to similar difficulties in the high-lead alloys. The oxidation of impurities during melting or the degassing of liquid metal is frequently practiced in the leaded, and zinc-free, copper-base compositions. Stirring the metal prior to casting, pouring at the lowest practicable temperature, and using chills, or metal molds, have all been accepted as desirable procedures for handling the leaded copper-base alloys. The American Foundrymen's Society publication "Recommended Practices for the Sand Casting of Nonferrous Alloys" provides an excellent general guide.

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References

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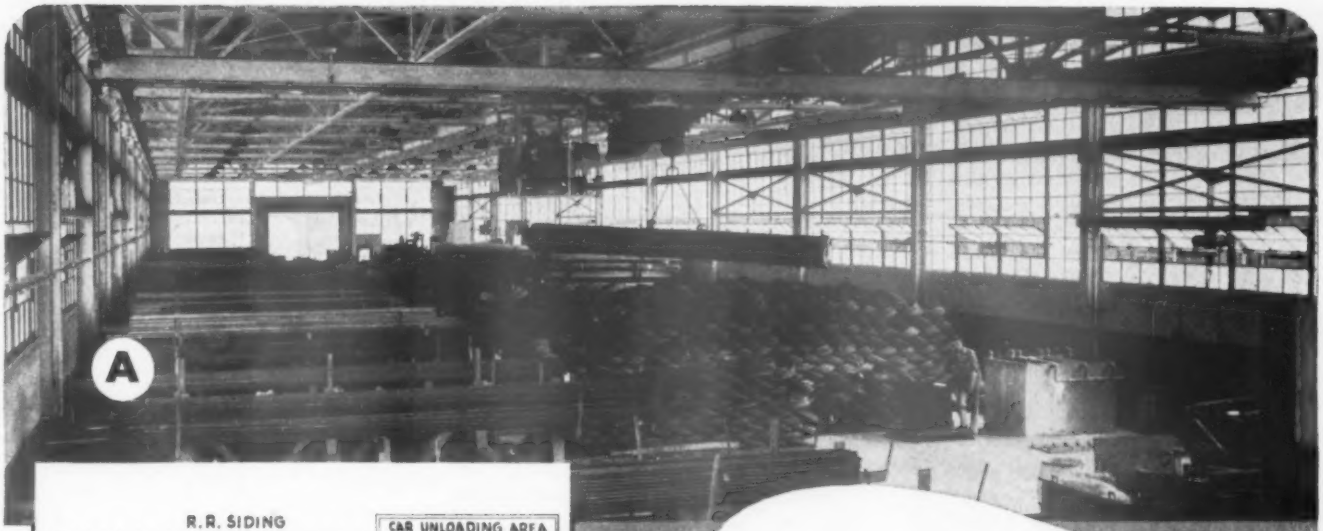
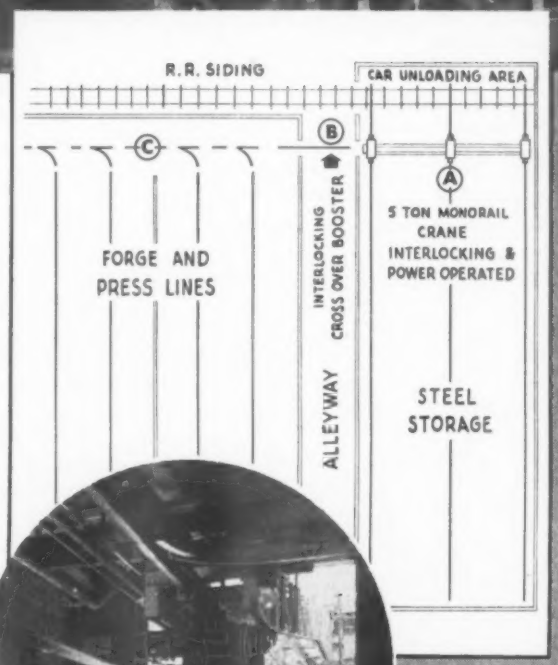
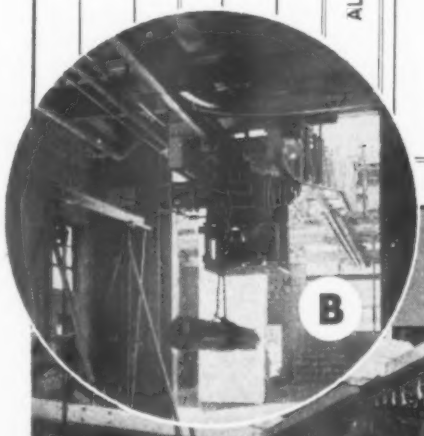
2. Clamer, G. H., Discussion of Pilling and Kihlgren paper on "Casting Properties of Nickel Bronzes", *Transactions*, AFS, Vol. 40, 1932, p. 289.
3. Trade-Mark registered, U. S. Patent Office.
4. *Sheet Metal Industries*, June 1946, p. 1087.
5. Eash, J. T., "Nickel-Antimony-Lead-Copper Bearing Alloys", *Metals Technology*, Vol. 12, December 1945, No. 8, 11 pages.







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At the Columbus plant of The Jeffrey Manufacturing Company, steel is unloaded from cars or trucks and placed in storage with a 5-ton high speed MonoRail crane. Stock is transferred from storage to press and forge shops by the same crane with carrier transfer across interlocking booster between storage and shops. Steel is distributed in shops by means of finger-tip control power operated MonoRail carrier.

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THE AMERICAN MONORAIL COMPANY

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New EQUIPMENT and Supplies

For Additional Information on these Items Use Reply Card—Page 217

1

(1)—Hoist: Philadelphia Division, Yale & Towne Mfg. Co., 11000 Roosevelt Blvd., Philadelphia 15—New ½-ton capacity hand chain hoist, weighing 37 lb, is said to be 95 per cent efficient, permitting a full load to be raised 3 ft in 20 seconds. Load brake is designed to provide split-second automatic braking when hoisting or lowering. Stabilizer ring speeds brake release for precise inching when lowering a load, permitting load to be eased gently to the floor or accurately spotted at any vertical distance above it. Heat treated alloy steel chain is provided for standard lift of 8 ft. Other models, weighing proportionally more are available in 1, 1½, and 2-ton capacities.

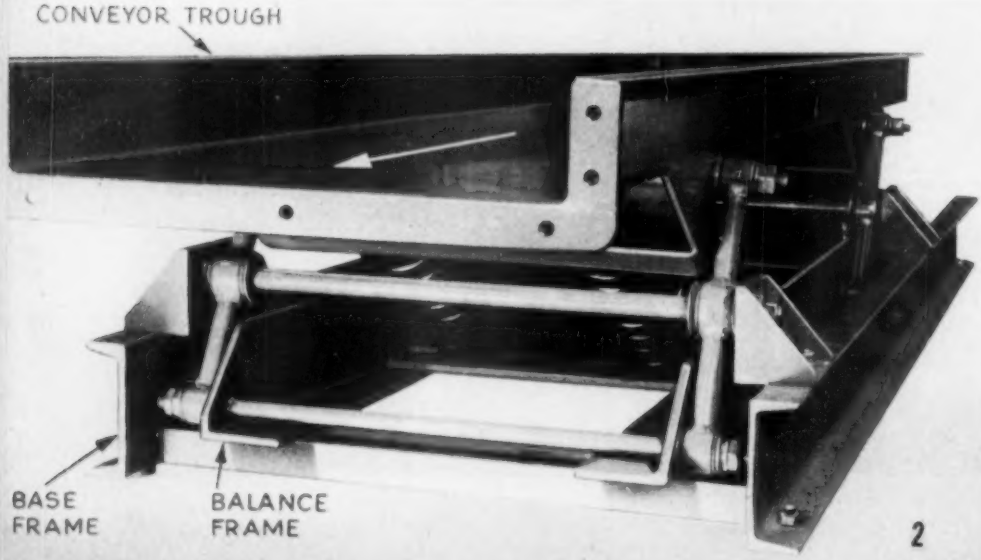
For More Details Circle No. 1—Page 217

(2)—Vibrating Conveyor: Stephens-Adamson Mfg. Co., 100 Ridgeway Ave., Aurora, Ill.—Natural frequency vibrating conveyor (balanced type) is designed for use where vibration transmitted to supporting structures is a problem. Coil springs proportioned to vibrate naturally at the frequency found best for conveying are used. By operating at natural frequency, or resonance, advantage is taken of the absorbed power which is regenerated, or returned, by the springs to start the next stroke. Since the conveyor is designed not to "creep," no heavy anchor bolts are required and it can be mounted or suspended. Designed to handle bulk materials, boxes or castings, the conveyor is offered in 10-ft sections, which can be combined with special sections up to 20 ft to achieve the desired length. One drive section can be used to operate entire conveyor. Flow speed is approximately 70 fpm, based upon a ⅜-in. amplitude of vibration and a normal frequency of 850 strokes per minute. A standard induction motor can be used, with speed reduced by V-belt to drive the eccentric at the natural frequency of the springs.

For More Details Circle No. 2—Page 217

(3)—Spindle Sander: Oliver Machinery Co., 1025 Clancy St. N. E., Grand Rapids 2, Mich.—Oscillating spindle sander has 37-in.-square cast iron table marked with 90 degree lines through center and removable cast iron throat plates for 2 and 4-in. drums. Drums up to 6 in. diam can be used in regular table. Rockers, 18 in. diam, permit tilting motor and spindle 45 degrees forward and 5 degrees back from vertical. Spindle oscillates 1⅛-in. with 56 strokes per minute at 1800 rpm of spindle and has vertical adjustment of 3 in. to insure wear on full 9 in. of sanding sleeves. Machine is equipped with 1 hp, 1800 rpm totally enclosed fan-cooled motor for 3-phase, 60-cycle, 220 or 440 v operation. Regular equipment includes 2, 4, and 6-in.-diam rubber drums each 9 in. long, mounted on 1-in. removable spindles, plus 2, 4, and 6-in. diam sanding sleeves.

For More Details Circle No. 3—Page 217



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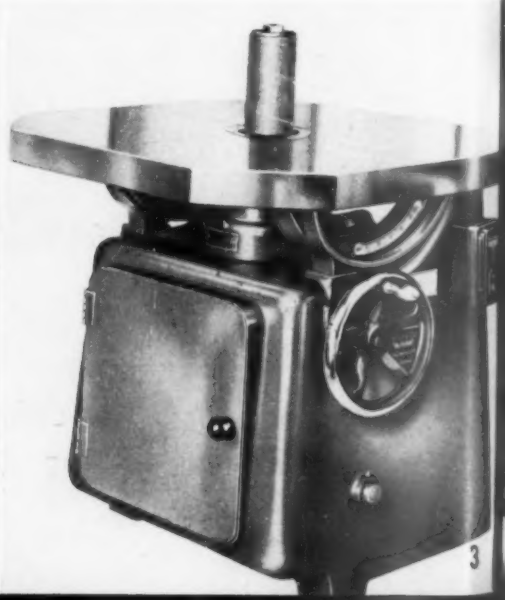
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(4)—Carbon Determination: Burrell Corp., 1942 Fifth Ave., Pittsburgh — Electronic instrument is designed for rapid and accurate determination of carbon by combustion. It will burn coarse, fine or pin samples of high or low carbon, plain or alloy steels or cast iron. The bench mounted, self-contained instrument is said to have these features: Instant heating, rapid analysis, visible combustion, a sturdy Vycor reaction tube, and availability in one or two tube models. Conventional ceramic boats with or without bedding material may be used. Company offers two types: 55 mm. long, 20 mm wide, 13 mm high, and 95 mm long, 13 mm wide, 12 mm high. Instrument operates on 115 or 230 v, 60 cycle, single phase current.

For More Details Circle No. 4—Page 217

Cut-off Wheels: Bay State Abrasive Products Co., Westboro, Mass.—Rough sided cut-off wheels of 6 to 20 in. in diam are designed for rugged, efficient, breakage-free cutting off or notching of ferrous, nonferrous and nonmetallic materials. They are said to resist common breakage from the twisting torque or lateral pressure that occurs frequently. They can be used wet or dry. These abrasive wheels are constructed of resenoid bonds reinforced with nylon fibres.

For More Details Circle No. 5—Page 217

Combination Burner: North American Mfg. Co., 4455 East 71st St., Cleveland 5—Changing from gas to oil (or vice versa) by throwing switches is a feature of a new packaged boiler burner unit. This automatic dual fuel unit is made in two sizes covering a range of 1½ million to 3¾ million Btu input for industrial and commercial heating or processing boilers. It burns #3 oil, or lighter, and natural or mixed gases. Boiler burner is factory wired and completely assembled. Operation of the burner is "on-off" in response to operating pressure or temperature limits set to suit. Safety devices shut off burner automatically in the event of flame failure, power failure or failure of any component parts of the burner assembly. It uses 115 v. single phase, 60 cycle current and gas at pressures as low as 2.5 in. w.g.

For More Details Circle No. 6—Page 217

Cab Air Conditioners: Dravo Corp., Fifth and Liberty Aves., Pittsburgh 22—Units that ventilate, heat, and provide dust and fume protection for operators of crane cabs are offered in two types. One type is designed to give continuous ventilation, heating, dust filtering, and fume protection. This unit is 16 in. deep, 26-in. wide and 42 in. high. The other unit performs the same functions except for fume removal. It has the same depth and width but is 26 in. high. Fan sections in these units can be rotated 90 degrees, enabling continuous discharge of fresh air from the top or either side. They can be installed on the crane cab in a horizontal, vertical or inverted position.

For More Details Circle No. 7—Page 217

Heat Control: Illinois Testing Laboratories Inc., 420 North LaSalle St., Chicago 10—Heating safety device was designed primarily as a constant stand-by safety control on automatic or manually operated furnaces in addition to existing controller circuits. However, it may be used as the only control instrument on processes that require a complete shutdown upon reaching a final preset temperature. In addition to shutting down heater circuits on all electric or fuel fired units, the instrument can be used to sound an alarm. Instrument also features thermocouple break protection—if the thermocouple or extension wire should open circuit for any reason, the heating equipment will be shut down automatically. Unit is available in scale ranges 0-600°F to 0-3000°F and their centigrade equivalents.

For More Details Circle No. 8—Page 217

Dry Sample Storage: Bethlehem Apparatus Co., Front & Depot Sts., Hellertown, Pa.—Apparatus for drying, storing and filing samples and specimens in industrial and scientific laboratories consists of a wide-mouthed glass jar 3 in. in diam and 7 in. high, with a screw lid. Rigidly suspended from the lid is a series of four metal storage shelves. On the bottom of the jar there is space for moisture-absorptive chemicals or other desiccating materials. This material is not in contact with the specimens, and it can be removed without unpacking the contents.

For More Details Circle No. 9—Page 217

Battery Charger: Motor Generator Corp., Troy, O.—Single circuit charger, automatic in operation, is designed to charge completely, 6-cell lead-acid batteries of up to 300 amp-hr capacity in 8 hr or less. To operate the charger, the operator inserts plug connection to battery, and then moves the time clock switch to the charge position, which automatically energizes the magnetic coil of the motor starting switch, starting the charge. Charger is stopped automatically by the time clock switch.

For More Details Circle No. 10—Page 217

Metal Dust Collector: Delta Power Tool Division, Rockwell Mfg. Co., 600 East Vienna Ave., Milwaukee 1—Self-contained, portable, metal dust collector may be attached to all types of abrasive units such as grinding, sanding, polishing, buffing, and other machines. A squirrel-cage type fan draws in air at 350 cfm, carrying fine and coarse dust and small particles through an air filter. The standard filter is fireproof and may be removed for cleaning. Pressed steel filter cabinet has a filter access door at back and a motor inspection door at top. A lubricated-for-life ball bearing motor is in a separate dust-proof compartment.

For More Details Circle No. 11—Page 217

Thermocouple: Wheelco Instruments Co., 847 West Harrison St., Chicago 7—Molten metal thermocouple for ferrous metals is an immersion type sensing unit for use with any pyrometer. It has an adjustable extension and uses a 27-gage platinum-platinum 10 per cent rhodium element. A "telescoping" feature permits feeding the platinum element to the proper length within the protecting tube, without the need for reassembling the unit, it is claimed. It is designed to withstand melting temperatures up to 3200° F and all casting temperatures normally encountered in the production of precision steel castings. Temperature readings are said to be made accurately in less than 30 seconds.

For More Details Circle No. 12—Page 217

Motors: Allis-Chalmers Mfg. Co., 1032A South 70th St., Milwaukee 1—Bracket-bearing, squirrel-cage induction motors of four and more poles have been redesigned to provide more protection and greater accessibility over previous models. The standard motor now is drip-proof; splash-proof motors with internal baffling of air

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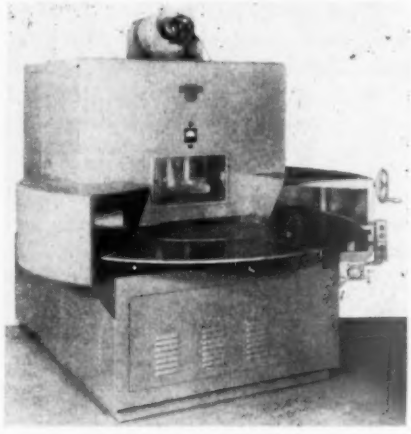
passages also are available. The motors are offered with special electrical modifications to suit application requirements. They can be had with antifriction bearings whenever the speed and application are suitable. Bracket-bearing, squirrel-cage induction motor construction is standard for ratings up to 1 hp per rpm. For steady, nonoverloading industrial drives (such as centrifugal pumps, blowers and fans) bracket-bearing construction may be used for ratings up to approximately 1.5 hp per rpm for motors in the high speed class up to 900 rpm.

For More Details Circle No. 13—Page 217

Core Baking: Induction Heating Corp., 181 Wythe Ave., Brooklyn 11, N. Y.—Electronic core baking turntable designed for one-man operation has a capacity of 350 lb of



sand cores per hour. Unit will bake cores up to 15 in. wide, 28 in. long and a maximum combined height of core and core plate of 8 in. The 72-in.-diam turntable has adjustable speed up to 6 fpm. An electro-mechanical device automatically maintains optimium operating efficiency regardless of core height, it is said. Electrical requirements are 12 kva, 220 v, single phase, 60 cycle.

For More Details Circle No. 14—Page 217

Spray Nozzle: Bete Fog Nozzle Inc., 85 Pierce St., Greenfield, Mass.—New three-way water spray nozzle for use in fighting fires is designed to be changed from full fog to straight stream to complete shut-off by a turn of the handle. It is said to be self-cleaning and practically nonclogging. Unit gives a full cone spray pattern with an inner spray cone that provides safety for the operator as it eliminates air pockets and drives the fire away. The outer cone gives coverage and a fine fog to extinguish the fire quickly with a minimum of water, it is claimed. Nozzle can be operated on any pres-

(*Continued on page* 220)

HELPFUL LITERATURE

50. Roof Ventilator

American Machine & Metals, Inc., DeBothezat Fans Div.—2-page illustrated leaflet DR-27-50 is descriptive of motor-driven vertical discharge roof ventilators available with 36, 42 and 48-in. diameter fan wheels and capacities up to 40,900 cfm. Units are weatherproof at all times.

51. Self-Dumping Hopper

Roura Iron Works, Inc.—4-page illustrated bulletin PM-100 describes and depicts how self-dumping hopper can be used in conjunction with fork or platform lift trucks to expedite unloading material. Units can be obtained in ½, ¾, 1, 1½ and 2-cu yd sizes.

52. Magnetic Separators

Magnetic Engineering & Mfg. Co.—4-page illustrated catalog No. 350 explains operation and design of models D and DH Memco High Power drum type magnetic separators for removal of tramp iron, iron flour and other ferrous turnings, borings and chips from wide range of industrial materials.

53. Processing Equipment

R. C. Mahon Co.—12-page illustrated catalog No. A-650 covers line of complete finishing systems: metal cleaning, pickling and rustproofing equipment; dry-off ovens and cooling tunnels; spray booths; flow and dip coaters; sludge segregators and unloaders; drying and baking ovens; dust collectors and fog filters; pressure vessels; conveyor racks and special production equipment.

54. Bentonite

Wyontana Mining Co.—8-page illustrated folder "Terra-Gel" tells story of this Wyoming bentonite for rotary drilling. Organic or mineral in nature, material forms gel upon mixing with water. Properties of gelatinization, viscosity and thixotrophy make material especially suited for use in rotary drilling muds.

55. Cutting & Welding Equipment

Alexander Milburn, Inc.—Illustrated catalog depicts oxyacetylene cutting and welding apparatus; regulators for oxygen, acetylene and other gases; accessories and portable carbide lamps.

56. Deoxidizer

Electro Refractories & Alloys Corp.—4-page illustrated bulletin D-850 on Electro-Carb briquets explains results obtainable with this silicon carbide deoxidizer in producing various types of iron castings.

57. Packaged Cutoff Wheels

Chicago Wheel & Mfg. Co.—6-page illustrated folder "Moisture-free Chicago Cut-Off Wheels" explains how moistureproof packaging delivers wheels to user in factory-fresh condition to assure long life and fast cutting action.

58. Metal-Heating Furnaces

Johnson Mfg. Co.—4-page illustrated bulletin No. 1100 covers line of oil or gas-fired metal-heating furnaces, burners and equipment engineered and built for specific services. Typical units are depicted along with accessory blowers and controllers.

59. Flexible Metal Hose

Atlantic Metal Hose Co.—Illustrated catalog No. 500 consists of three sections which deal with flexible metal interlocking high pressure hose, air-jacketed hose for diesel exhausts and conveyor hose for ventilating applications; flexible metal seamless hose for high-pressure applications; and metal and synthetic rubber-lined gasoline hose.

60. Vacuum Cleaner

National Super Service Co.—4-page illustrated form 505:10 describes model E heavy-duty portable electric vacuum cleaner designed expressly for industrial service. Special attachments for specific cleaning applications are covered.

61. Foundry Equipment

Harry W. Dietert Co.—Two 2-page illustrated bulletins describe dial type Brinell hardness reader that reads directly from impression made in usual manner; No. 625 foundry hydrometer for use in measuring concentration of all types of core and mold coating mixtures; and No. 820 chaplet height indicator that simplifies selection of proper chaplet for each location.

ADDITIONAL INFORMATION?

For additional information on any of the items described under "New Equipment and Supplies", "Trade Publications" or "Helpful Literature" in this issue — simply circle their corresponding item numbers on one of these cards.

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62. Metal Applicator

Tincher Products Co.—20-page illustrated bulletin C8501 is entitled "The Tincher Process for Recovery of Rejects Due to Porosity in Castings and Parts." Question and answer technique is used to explain operations of the BlockBinder metal applicator. This electric machine lays metal in holes, cracks and other defects in gray iron, bronze, brass and aluminum castings.

63. Induction Carbon Apparatus

Fisher Scientific Co.—6-page illustrated bulletin presents information on completely automatic high frequency induction heater which makes possible rapid and accurate carbon determinations in all types of ferrous materials from steels with low carbon content to stainless steels and cast irons.

64. Drilling Machines

Buffalo Forge Co.—12-page illustrated bulletin No. 2989-F depicts No. 22 drilling machines available in round column or pedestal types. Units can be furnished with sensitive or power feed and with single or multiple spindles.

65. Impact Tool

H. K. Porter Co.—Illustrated pocket-size folder depicts and describes Impakdriver tool for loosening or tightening screws, bolts or nuts.

66. Industrial Ovens

Despatch Oven Co.—Three illustrated bulletins Nos. 30, 31 and 84 are descriptive of gas and oil fired conveyor type foundry ovens, batch type Coremaster foundry ovens and CF furnaces which develop temperatures up to 850° F.

67. Electric Arc Furnaces

Whiting Corp.—40-page illustrated catalog FY-168 features Hydro-Arc electric arc furnaces and discusses advantages and costs of electric melting. Design of electrode arms and clamps as well as methods of positioning are explained also.

68. Safety Tongs

Heppenstall Co.—22-page illustrated booklet "Automatic Safe-T-Tongs" is descriptive of tongs for use with hoist or crane which require neither riggings on load nor ground operators. Nonelectric units are dropped on burden to be lifted and go through entire cycle of operation automatically.

69. Portable Pyrometer

Illinois Testing Laboratories, Inc.—2-page illustrated bulletin No. 1724-D is descriptive of Alnor Pyro Lance portable pyrometer for nonferrous foundries and which is designed for accurate temperature measurements under severe operating conditions.

70. Electric Process Heating

Jensen Specialties, Inc., Advance Heating Div.—6-page illustrated bulletin explains electric process heating systems that utilize standard construction components to form ovens, driers and booster heaters for wide variety of industrial heating requirements. All units can be assembled on-the-job from fully-insulated prefabricated parts.

71. Materials Handling

Union Metal Mfg. Co.—24-page illustrated catalog 77 features line of corrugated steel boxes, skids, pallets and combination units designed to increase effectiveness of materials handling. Intended applications in handling, production flow and storage situations are depicted.

72. Gear-Type Coupling

Ajax Flexible Coupling Co.—6-page illustrated bulletin 50 tells how Dihedral coupling is adequate to handle up to 7 degrees misalignment with maximum tooth contact and minimum backlash. Seven sizes are available with maximum bore sizes up to 5 in. and with capacities up to 350 hp at 100 rpm.

73. Magnetic Separator

Eriez Mfg. Co.—2-page illustrated bulletin B-557 describes Extrapower, Ultrapower and Superpower magnetic separators of ATOMagnet line which are constructed for use on wood or metal chutes, hoppers and tables to remove tramp iron from material in process.

74. Grinders & Buffers

Brown-Brockmeyer Co.—2-page illustrated bulletins 1010, 1020 and 1030 cover bench grinders, pedestal grinders and buffers, and grinder-buffers, respectively. Standard and special types of each class are shown and features, capacities and applications are discussed.

75. Core Binders

Monsanto Chemical Co.—12-page illustrated technical paper "Phenolic Resin Core Binders" is reprint of paper presented by J. E. McMillan and J. A. Wickett at the 54th Annual AFA Convention. Discussed is effect of core composition on physical properties of cores.

76. Overhead Traveling Cranes

Whiting Corp.—20-page illustrated section 300, unit 75 describes E-type cranes built in capacities ranging up to 12 tons and with spans from 20 to 60 ft. Designed for intermittent duty, they utilize fluid drive and magnetic control.

77. Aluminum Cable

Reynolds Metals Co.—16-page illustrated booklet briefly describes operations at company's Listerhill, Alabama plant where alumina is processed into aluminum sheet, foil, cable, wire, rod, bar and other aluminum products. Production of steel-reinforced aluminum electric cable is explained and operations depicted.

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SOFFEL'S
New THERMOTOMIC-X
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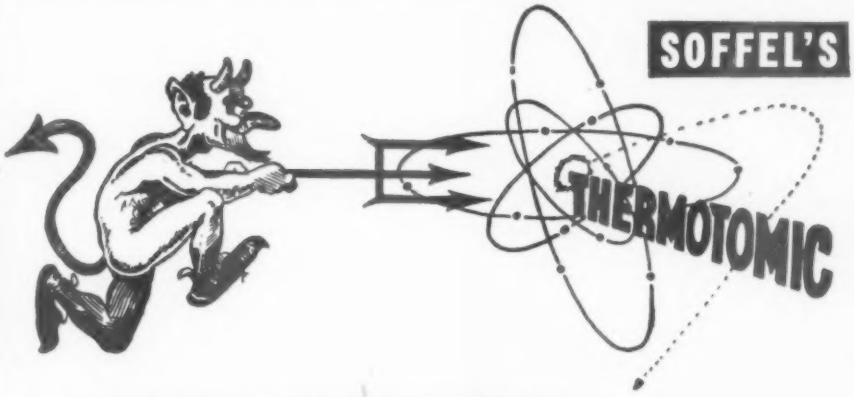
exothermic metal feeding compound

√ Cuts Casting Costs

√ Makes Better Castings

FOR STEEL, STAINLESS STEEL, GRAY OR MALLEABLE IRONS, COPPER, BRASS, BRONZE AND ALUMINUM

A new, improved, hotter and faster acting THERMOTOMIC X will increase temperatures and fluidity in the risers without bubbling and boiling. A means of introducing heat energy into the feeding metal in the heads or risers of castings or at other localized points in the mold by the use of inserts or as a facing. Increased yield by the reduction of heads, control of directional feeding and the elimination of scrap due to piping, porosity and shrinkage are the results to be obtained by the use of this patented compound. Thermotomic ABC and AL-X31 Liquidizer are recommended for aluminum.



Reduces Size of Risers and Feeder Heads

Heads and Risers Removed without Cutting and Burning

Increases Yield

Eliminates Shrinkage and Piping in Castings

WHAT IS THERMOTOMIC?

Thermotomic Compound is an exothermic material which can be molded and baked into any desired shapes just as sand cores are made. It produces a temperature of 3500° F. It is used as ring inserts under the risers or feeding heads, or as facing inserts where it is desirable to maintain the fluidity of the metal in the mold at those points where rapid cooling may cause piping, shrinkage or segregation. Great savings are realized through reduced riser dimensions and cleaning costs. For use in green sand molds, use Thermotomic WP (waterproofed). Soffel's Carbon-Free Liquidizer No. 5 is recommended for use with Thermotomic feeding compounds on top of the feeding heads.

EXOTHERMIC CARBON FREE LIQUIDIZER

SOFFEL'S EXOTHERMIC CARBON FREE LIQUIDIZER is the leader in major foundries for use on ferrous and nonferrous metals, and in ingot production. It is the first and the original scientific non-carbon exothermic compound for feeding heads and risers.

SOFFEL'S EXOTHERMIC CARBON FREE LIQUIDIZER is different from ordinary head compounds in two ways: It is CARBON FREE, thereby eliminating carbon pick-up. It is EXOTHERMIC. Carbonaceous materials, regardless of their composition, will cause carbon pick-up, segregation, non-uniform grain structure and hard spots under risers and in castings. Carbonaceous materials contribute no added heat value or increased temperatures to the feeding metal and only act as an insulating cover.

SOFFEL'S EXOTHERMIC CARBON FREE LIQUIDIZER reacts within itself exothermically, producing a temperature above 3200° F. actually increasing the temperature of the feeding metal to a point well above that of the metal in the main body of the casting, thus ensuring that the feeding metal will be the last to freeze. Shrink cavities in the casting caused by premature freezing of the feeding metal are eliminated. After the exothermic action has ceased, the LIQUIDIZER forms a soft insulating blanket on the metal. This confines the heat generated by the LIQUIDIZER and aids in maintaining the desired high temperature of the feeding metal in the heads.

DENSILTITE IRON LADLE FLUX

DENSILTITE is guaranteed to clean the metal, increase the fluidity and reduce sulfur and phosphorous. Tensile strength and elongation are greatly increased. No special handling equipment is required, simply apply in the bottom of the ladle or into the stream of metal from the cupola and the exothermic action of Densiltite instantly increases the temperature about 200° F., reducing sulfur, phosphor, oxides, gas and other impurities in the metal. It is not a salt or soda base flux, and there are no obnoxious fumes or smoke to contend with. A dry slag results from its use. Does not gum up the ladle.

"Beware of Imitations"

Pittsburgh Metals Purifying Co.

Manufacturers of Quality Fluxes and Purifiers for All Metals and Alloys

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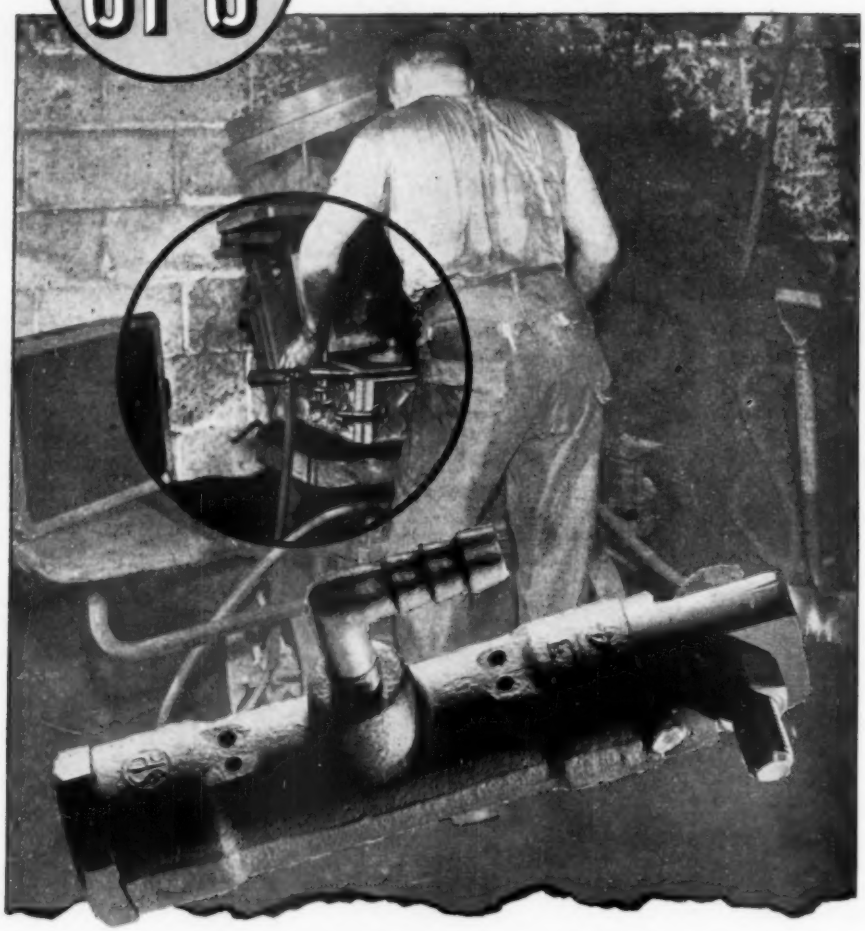
SPO AIR VIBRATORS



FOR LOW-COST EFFICIENCY AND LONG SERVICE LIFE

Powerful Series 76 **SPO** air-vibrators are foundry-engineered for maximum efficiency and low-cost operation. These durable impact-vibrators can be attached quickly and easily to match-plates, sand hoppers, flasks, and other foundry equipment to deliver powerful vibration anytime and everytime it's needed.

Available in 8 sizes, with piston diameters ranging from ½ to 2½ inches, Series 76 vibrators feature a **special bronze alloy cylinder liner** that provides permanent piston lubrication and greater operating efficiency.

SPO vibrators start instantly with full power and deliver from 2200 to 6000 impacts per minute on standard 80 p.s.i. line pressure, depending upon piston diameter. Both piston and cylinder ends are uniformly hardened to resist powerful blows and to assure a longer, trouble-free service life.

SPO offers a complete factory-rebuild service, **at cost,** which is guaranteed to make your **SPO** vibrators good-as-new. Send your **SPO** home for repair . . . and it will perform at peak efficiency for years . . . and years . . . and years.

SPECIFY SPO FOR POWERFUL, DEPENDABLE VIBRATORS

WRITE FOR CATALOG

SPO INCORPORATED

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(*Continued from page* 216)

sure from 30 to 150 lb, using, at 100 lb, about 8 gpm for fog and 10 gpm for straight stream. It is furnished with a standard "garden hose" thread, and is made of stainless steel and chrome plated brass.

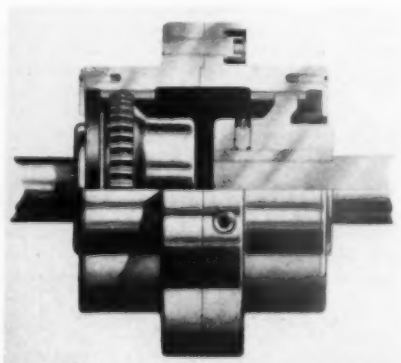
For More Details Circle No. 15—Page 217

Collapsible Box: Phillips Mine & Mill Supply Co., 2306 Jane St., Pittsburgh 3—Collapsible, 2000-

lb capacity box for storing and transporting bulk materials and parts folds down to a height of 9 1/16-in. with a level top surface. In the erected position the box is 28⅛-in. high, with a 49 x 37 x 24-in. box interior and permits a fork lift truck or pallet truck to enter from all four sides. Each side is held in the upright position by a new type latch with safety catch. Box is made of welded steel with a corrugated design. A small "table" is incorporated on the inside of the legs for stability in stacking and to prevent spreading of the sides. A 5000-lb capacity box also is available.

For More Details Circle No. 16—Page 217

Dihedral Coupling: Ajax Flexible Coupling Co., English St., Westfield, N. Y.—Dihedral coupling is designed to handle angular and offset misalignment up to 7 degrees with a standard coupling and up to 12 degrees

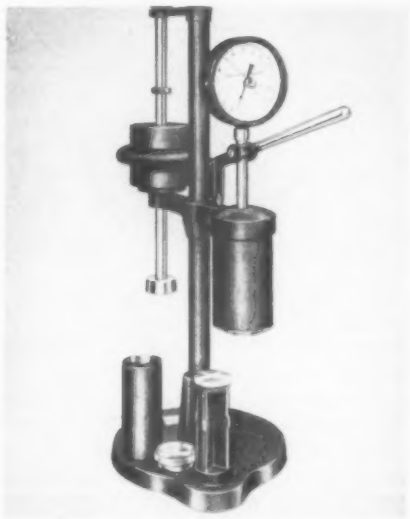


with special models. Misalignment capacity and performance of couplings are based on a dihedral tooth shape which provides for maximum misalignment with minimum clearance or

backlash. Under all practical conditions of misalignment, the driving area is at the center of the tooth where it is the strongest. Dihedral surfaces of splines provide that at maximum rated misalignment, the driving area is spread over an entire half tooth. Use of the coupling saves time in lining up equipment and reduces alignment problems caused by normal bearing wear or shifting of structural mountings. Couplings are made in a graduated line of standard sizes and capacities. They also are available as flangeless or sleeve type for use where outside diameters must be held to a minimum.

For More Details Circle No. 17—Page 217

Sand Testing: Claud S. Gordon Co., 3000 South Wallace St., Chicago 16—Preparation of sand specimens and their compression testing are combined in an instrument designed to conform to the recommendations of the committee on foundry sand research of the American Foundrymen's Society. In the testing operation pressure is applied gradually by hand until the specimen collapses.



Maximum pressure in pounds per square inch is indicated by the free pointer on the gage. All moving parts are above the sand specimen as an aid in keeping the parts clean.

For More Details Circle No. 18—Page 217

Hoists: Ohio Electric Mfg. Co., 5900 Maurice Ave., Cleveland 4—Electric cable hoists with capacities of ½ to 5 tons have motor enclosed within the cable drum, reducing overall dimensions and weight. Load sustaining parts are made from steel forgings and castings providing a safety factor of over 6 to 1. Motor and gears run in ball bearings. Gear reduction is by a double internal (epicyclic) gear train that incorporates two Weston-type load brakes. Equalizing solenoid type mo-

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USE NO HOOKS
100 LBS.
ANGULAR
GRIT
MANUFACTURED BY
PITTSBURGH CRUSHED STEEL CO.
PITTSBURGH, PA. U.S.A.
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is 2 ways better!
1 MORE ECONOMICAL . . . "Certified" Samson Shot and Angular Grit save you money because they last longer . . . give you top-efficiency blast cleaning at lowest cost. Each grain is a solid homogeneous mass that wears slowly . . . can be used over and over.
2 CLEANS BETTER . . . Special automatically controlled hardening process gives "Certified" plenty of extra hardness to clean castings better. Order "Certified" today for faster, better, cheaper blast cleaning.
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ACCEPTED AND USED FOR OVER 55 YEARS
PITTSBURGH CRUSHED STEEL CO.
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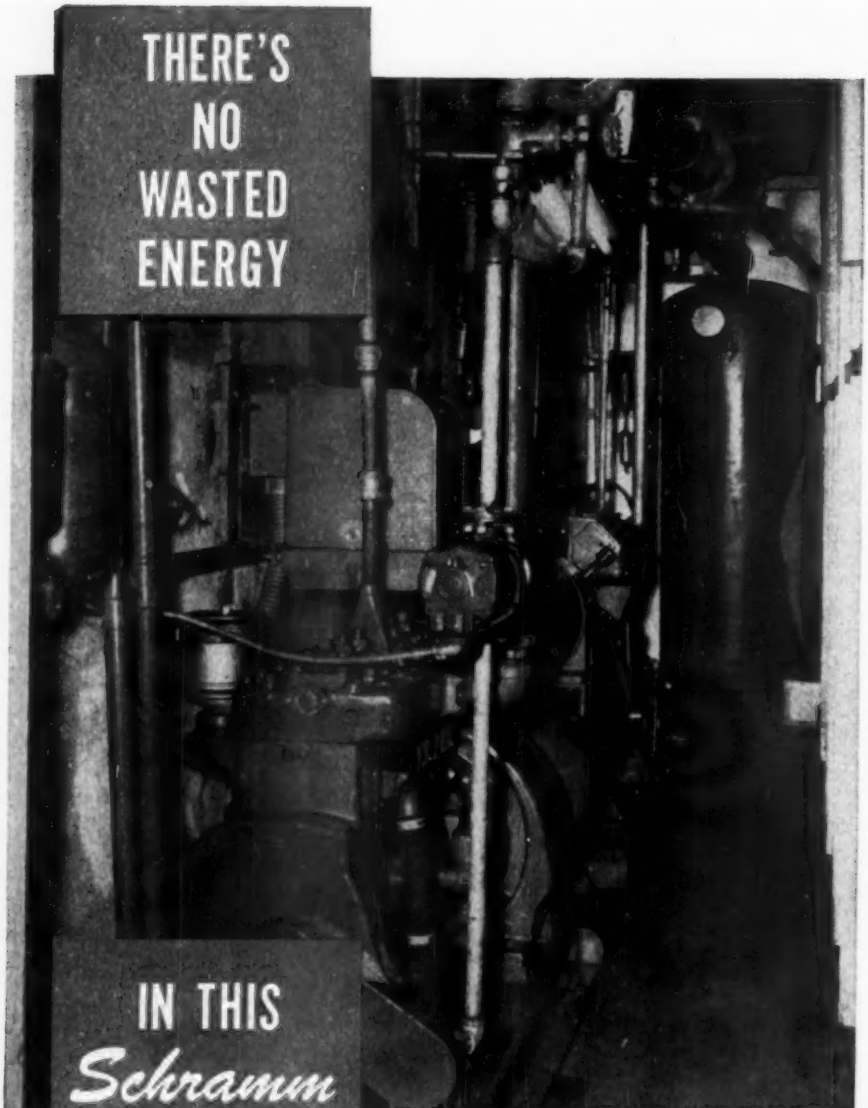

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Three of ten SCHRAMM Air Compressors installed in the various shops of Boyertown Auto Body Works, Boyertown, Pa., not only provides air for operating pneumatic tools and appliances, but goes even futher—and delivers BTU's into a system suitable for space or process heating; providing warmth and comfort in winter and air conditioning in summer! By taking full advantage of the uses to which Schramm Air Compressors may be put, naturally, profits result.

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tor brake is connected to an up limit cutoff switch. Load hook oscillates and swivels on roller bearings and is suspended on a 5/16-in. preformed plow steel cable that can be replaced without disassembling any part of the hoist. Designed for operation on 220, 380, 440, or 550 v, 3-phase, 60 cycle current, the hoist is furnished with either pendant rope control or push-button control on pendant cable which has a strain relief cable from the hoist to the control. Voltage at the control is 110.

For More Details Circle No. 19—Page 217

Air Line Lubricator: Keller Tool Co., 1333 Fulton St., Grand Haven, Mich.—Large size air line lubricator automatically supplies oil to one or more tools where air at a minimum of 10 cfm is used by one tool and a

maximum of 60 cfm by all tools taking air through the lubricator. A transparent Plexene bowl, designed to hold 6 oz of light oil, provides oil feed through a porous bronze wick. No regulation of the oil flow is necessary, it is said. When used with a 35 cfm tool, the bowl holds enough oil for 8 to 10 weeks lubrication under normal usage. Pressure drop through the lubricator normally does not exceed 1 psi, it is claimed.

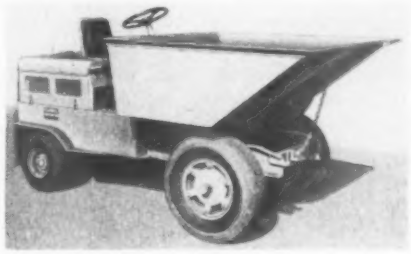
For More Details Circle No. 20—Page 217

Line Burners: Vapofier Corp., 10316 South Throop St., Chicago 43—New series of line burners is designed for use on applications employing natural, manufactured, propane or butane gases mixed with air by any conventional gas-air mixing equipment. Various shaped and length sections are available to provide any pattern of flame required. All ends are flanged for convenient assembly and provide for a large variety in burner arrangement. Burners are designed so that positive ignition and flame retention takes place throughout the assembly instantaneously. Constant ignition is

maintained by ignitor ports (under lip of burner) which ignite the gas, issuing from the center holes. This flame retention feature is said to allow these burners to be subjected to passing air without the flame "blowing off."

For More Details Circle No. 21—Page 217

Haulage Vehicles: Clark Equipment Co., Industrial Truck Division, Battle Creek, Mich.—Rede-



signed haulage vehicles have new two-speed transmissions permitting 14 mph travel in high gear and 8 mph in low, in both forward and reverse. Wheelbase, overall length and turning radius have been decreased. Stability and strength have been increased by four-wheel construction and redesigned frame. Distributor, starter and generator are enclosed, and spark plugs have rubber covers, making the electrical equipment virtually dust-proof. Lubrication and maintenance points are readily accessible, and a water pump circulating system is said to assure proper engine cooling. Vehicles are offered in tip or dump models, each with a capacity of up to 40 cu ft and 4000 lb.

For More Details Circle No. 22—Page 217

Respirator-Goggle: American Optical Co., Southbridge, Mass.—Combination rubber frame goggle and respirator—fastened with either snap

or rivet—is recommended for protection against chemical splashes, spray, light impact of foreign particles and exposures to fine dusts. Ventilation is indirect to keep acid and dust from

STANDARD CONVEYORS

Cut Costs — Speed Operations — Give You

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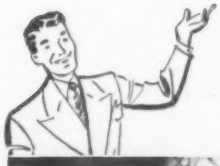
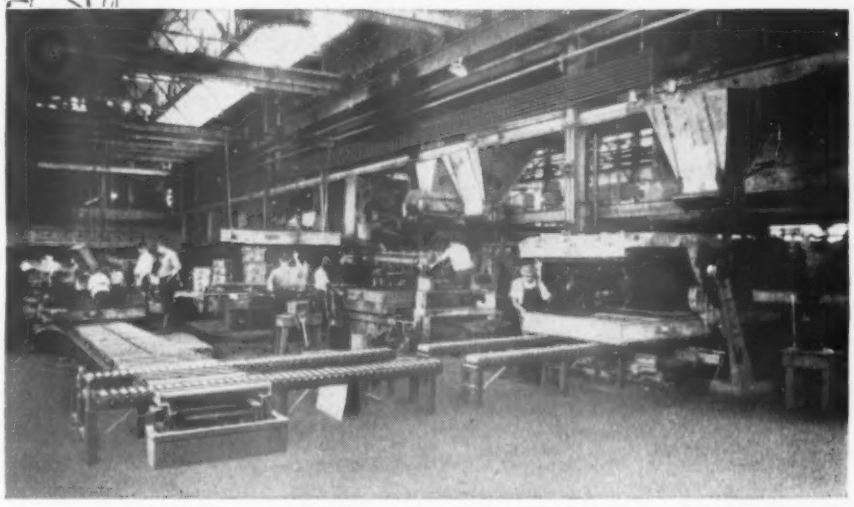


✓ CONSERVE AND UTILIZE EXISTING FOUNDRY SPACE



STANDARD CONVEYOR COMPANY is able, through long experience to specify and build for every foundry handling need

Standard designs and builds conveyors expressly for foundry service — equipped with shielded and sealed bearings, protected against heat, dirt, sand, chips and grit for long-time, trouble-free operation.

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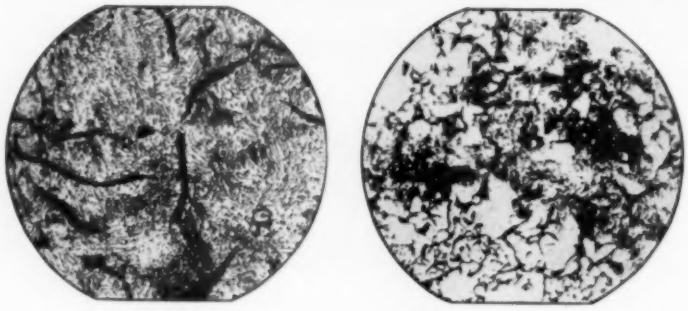

GOOD BAD

Although the irons in the photomicrographs above have the same composition and Brinell Hardness, tool life was increased 100% thru structure control and at no increase in cost

CROBAUGH LABORATORIES
ESTABLISHED 1894
COMPLETE METALLURGICAL LABORATORY
FOUNDRY CONSULTING SERVICE
THE FRANK L. CROBAUGH CO.
CLEVELAND 13, OHIO

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Industrial EQUIPMENT COMPANY
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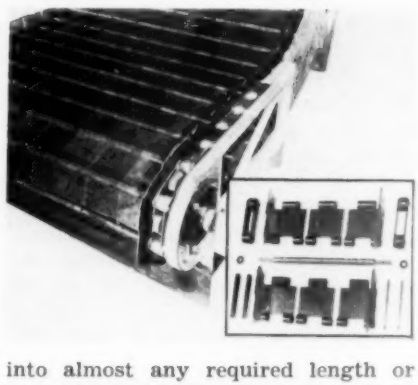
eyes. Shatter-resistant, replaceable acetate lens provides wide-angle vision. A gas-tight model also is offered.

For More Details Circle No. 23—Page 217

Vibrators: SPO Inc., 6449 Grand Division Ave., Cleveland 5—Pneumatic vibrators are designed for intermittent or continuous operation on all types and sizes of storage bins, hoppers and chutes handling powdered or granular materials. They deliver hammer-like impacts in a direction 90 degrees to material flow to prevent arching-over or plugging of container centents and assure a steady flow through chutes. Vibrators are available in 1⅝, 2, and 2½-in. piston sizes, and are equipped with ¼-in. rigid or swivel type straight or ell connector for hose attachment.

For More Details Circle No. 24—Page 217

Steel Belting: May-Fran Engineering Inc., 1692 Clarkstone Rd., Cleveland 12—Hinged steel conveyor belting is designed for easy assembly



into almost any required length or width from stocked component parts. Links are made from steel plate and are fastened by steel rods so that the side chains become an integral part of the conveyor belting. Outside belting links have interlocking side wings which remain engaged at all times. Special link and rod design, in conjunction with the side wings, reduces fall-through of materials handled. Individual steel links come in pitch sizes of 2½, 4, 6, and 12 in. These links can be assembled to form belting of almost any length and in widths from 6 in. to 6 ft. Links can be perforated or solid. Standard belting handles working loads up to 300 lb per lineal foot and special belting can be supplied to handle heavier loads.

For More Details Circle No. 25—Page 217

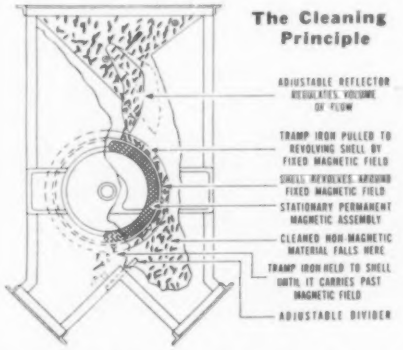
Glove: Richmond Glove Corp., Richmond, Ind.—New work glove is made of gray cowhide with striped herringbone flannel back and has a water-resistant cuff which may be dry cleaned. It has a seamless first finger and reinforced welting around

the second and third fingers. A double stitch is used along the back from cuff to first finger. The glove has one continuous seam on the back of the thumb and no seams on the front. A seamless palm also is incorporated in the glove. These features are said to increase the life of the glove. A heavy elastic band is

used for form fitting around the wrist. A white canton flannel lining is provided for finger and palm comfort. Leather knuckle straps and tips are offered as additional hand protection.

For More Details Circle No. 26—Page 217

Magnetic Drum: Eriez Mfg. Co., 629 Commerce Bldg., Erie, Pa. —Permanent magnetic drum is designed to remove tramp iron and medium fine ferrous contamination where materials are conveyed in spouts, chutes, or any other similar conveying system not employing belts. The magnet installation consists of a self-powered, revolving stainless steel cylindrical shell within which a stationary permanent magnet is located. Vanes are located longitudinally across the face of the cylinder, and the material falling against these vanes rotates the cylinder. As shown in the diagram, sand is directed into a hopper where-



in the rate of flow is regulated. Sand then falls into the revolving steel shell. The magnetic tramp iron adheres. Nonmagnetic sand falls off and out through a discharge chute. The iron sticks to the shell until rotated out of the magnetic field then is released and discharged separately.

For More Details Circle No. 27—Page 217

DINGS NON-ELECTRIC MAGNETIC PERMA-PULLEY

Reg. U.S. Pat. Office

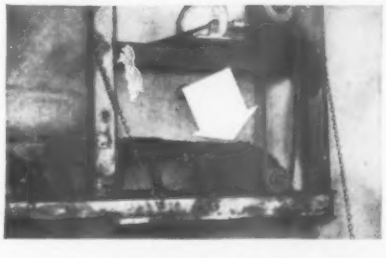
Eliminates Hand Labor! This Perma-Pulley was purchased to remove ordinary iron from sand. It was soon found that it would extract gaggers formerly removed by hand; thus a costly, time-consuming manual operation was eliminated.

NEWER, BETTER, LOWER COST ANSWER TO YOUR MAGNETIC SEPARATION JOBS!

POWERFUL, self-energized, Alnico magnet Perma-Pulleys are the modern, trouble-free answer to removal of iron from sand. No electrical maintenance — withstand heat — magnetic strength certified — magnetic permanence *guaranteed* for the life of the unit. WRITE FOR CATALOG C-1007A TODAY.

Weatherproof!

This portable unit gives great flexibility! This foundry kills two birds with one stone, uses a portable Perma-Pulley Type Separator both inside and outside the plant. The Perma-Pulley is unaffected by weather. A typical Dings cost cutter!



Heat's No Problem Here

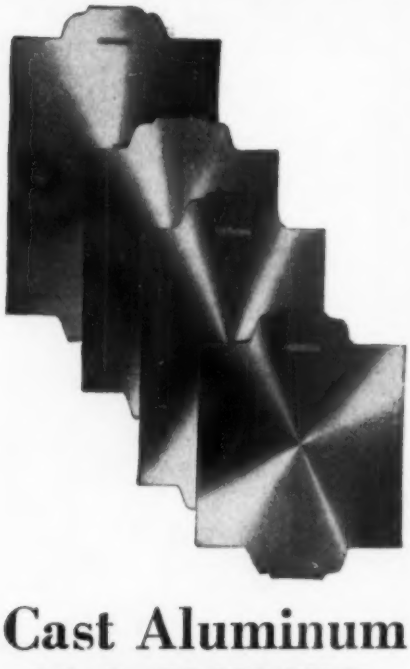
The Perma-Pulley is unaffected by temperatures up to 600° F. This unit handling hot sand will last for years without maintenance.

To cut your costs put a Perma-Pulley in your plant.

DINGS MAGNETIC SEPARATOR CO.

4708 W. Electric Ave., Milwaukee 14, Wis.

Dings Certified MAGNETIC STRENGTH



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All standard flask sizes are carried in stock. All plates are cast with one inch flask margin all around PLUS large, well shaped ears for flask pins and vibrator. Order by flask size, not plate size. It will pay you to investigate this source for quality plates.

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For 3/8" Plates, Add 33 1/3% For 1/2"

10 x 16	$8.25	12 x 18	$9.90
10 x 18	8.80	13 x 16	9.65
11 x 16	8.55	14 x 14	9.35
11 x 18	9.35	14 x 16	10.15
12 x 14	8.55	14 x 18	12.10
12 x 16	9.05	16 x 16	12.10

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Special Shapes and Thicknesses to Order

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ERIE, PA.

FRENCH FOUNDERS TOUR COUNTRY

To Study Malleable and Steel Practice

DURING the week of Oct. 2 twenty malleable and steel foundrymen from France visited Cleveland, the first stop on a six-week tour of foundries in the United States to gain first-hand information on practices and conditions. The group is visiting under the auspices of the Economic Co-operation Administration (Marshall Plan), Technical Assistance Program.

The party, under direction of Leslie A. White, project manager, ECA, is composed of Louis C. Desplanche, molder, Fonderies du Creusot, Creusot (Saone & Loire); Maurice M. Flour, technician, Acieries d'hirson, Hirson (Aisne); Jean P. A. Fontaine, foreman, Acieries de Paris & D'Outreau, Pont de Briques; Athos A. Gantois, foreman, Acieries de Sambre et Meuse, Feignies (Nord); Jacques Genot, general manager, Acieries et Fonderies, Doubs; Marcel Jaumain, engineer, Fonderies et Forges d'Alais-Us, Metallurgique de Tamaris, Tamaris (Gard); Adolphe J. Luchetta, head of division, Syndicat General des Fondeurs de France, Bois-Colombes (Seine); Gaston F. Martin, manager, Usines & Acieries de Sambre & Meuse, Feignies (Nord); Louis H. Mathieu, molder, Fonderies & Forges d'Alais, Tamaris (Gard); Michel Pelier, molder, Acieries & Fonderies du Doubs, Sainte-Suzanne (Doubs); Robert C. Perrot, engineer, Acieries de Paris & d'Outreau, Outreau (Pas de Calais); Jean B. Rible, division engineer, Fonderie le Creusot, Creusot (Saone et Loire); Rene N. E. Robert, foreman, Fonderies & Forges d'Alais, Tamaris (Gard); Georges A. Bachelet, molder, Fonderie des Ardennes, Mezieres (Ardennes); Georges A. Daugenet, engineer, Fonderie des Ardennes a Mezieres (Ardennes); Guy L. Brisville, general manager, Ets. Brisville, Nouzonville (Ardennes); Rene E. Dias, manager-owner, Dias, Coudekerque-Branche (Nord); Andre J. Grayraud, engineer, Sainte d'Aubrives & Villerupt, Villerupt (M & M); Michel C. Louis, molder, Ets. Gailly, Charleville, (Ardennes); Andre F. Servonnat, engineer, Societe Senelle Maubeuge, Maubeuge (Nord).

During the first two days in Cleveland the group heard discussions relating to various phases of the foundry industry in the United States. In the morning of Oct. 2 Lowell D. Ryan, managing director, Malleable Founders' Society, Cleveland, showed the colored motion picture "This Moving World" depicting malleable foundry operations, and spoke on the "Background of the Malleable Industry and the Function of Industrial Trade Associations." Following his talk James H. Lansing, technical and research director of the society, spoke on the "Technical Aspects of Malleable Foundry Operation." In the afternoon F. Kermit Donaldson, executive secretary, Steel Founders' Society of America, Cleveland, showed slide films of steel foundry operations and discussed the activities and services of the society to its membership. C. W. Briggs, technical and research director of the society spoke on the "Technical Aspects of Steel Foundry Operations."

On the morning of Oct. 3, George Dreher, executive secretary, Foundry Educational Foundation, Cleveland, spoke on "Engineering Education in the American Foundry In-

Twenty French foundrymen, representing the malleable and steel casting branches of the industry, visited Cleveland early in October at the beginning of a 6-week tour of foundries. Sponsored by the Technical Assistance Program of the Economic Co-operation Administration, the group will gather information on practices and methods

dustry," and Walton Woody, National Malleable & Steel Castings Co., Cleveland, and president of the American Foundrymen's Society, described advantages of foundry mechanization and modernization. In the afternoon Francis Burtt, director of industrial relations, American Steel & Wire Co., Cleveland, spoke on "American Labor-Management Relations," and James C. Quinn, Cleveland District Council, Congress for Industrial Organization, discussed "Function of CIO in Relation to American Industry."

Remainder of the groups' stay in Cleveland was devoted to visits to foundries in the city, Ashtabula, Canton and Massillon, O. Later the group will visit foundries in Columbus, Springfield, Lima and Toledo, O., Chicago, Milwaukee, Philadelphia, Chester and Eddystone, Pa.

Book Review

ASTM Standards 1949, Part 3, *Cement, Concrete, Ceramics, Thermal Insulation, Road Materials, Waterproofing, Soils,* cloth, 1344 pages, 6 x 9 inches, published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3. Price $8.

Contains nearly 330 standards and tentatives relating to cement, lime, gypsum, asbestos-cement products, thermal insulating materials, glass and glass products, magnesium oxychloride cements, refractories, natural building stones, mortar for unit masonry, masonry building units, pipe and drain tile, mineral aggregates, concrete and nonbituminous highway materials, bituminous materials for highway construction, waterproofing and roofing, and soils.

Standards are assembled in a sequence determined by the specific materials or products to which they apply. Table of contents lists the standards according to materials covered and numerical sequence of their serial designations. A subject index also is included in the back of the volume.

Sabotage Manual

National Foremen's Institute Inc., New London, Conn., has recently published a new booklet, "Sabotage—How To Guard Against It," designed for company distribution to employees. The booklet is a 12-page reprint of the manual of the same title, published in 1940, by Harry D. Farren, well known authority on sabotage. Price of the booklet is 25 cents for single copies, quantity discounts available.

OVENS FOR THE FOUNDRY by DRY-SYS

TWO COMPARTMENT BATCH TYPE MOLD OVEN—

Another Dry-Sys special purpose design, heated by thorough hot air circulation. Not a stock model, but like all Dry-Sys Ovens, custom-engineered for a particular application. This explains its low-cost dependable performance for uniformly excellent results on the schedule required. Its compact, heavy steel construction not only conserves floor space, but also saves the operator's time by permitting easy accessibility to all operating parts.

OVENS FOR CORES, MOLDS, LADLES, TEMPERING, ANNEALING, PAINTING

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The Military Looks to Industry

(*Continued from page* 94)

a few parallels observable in the situation today and in 1941. The recent voluntary allocations agreements in steel and copper have made headlines. We have had allocations, voluntarily, in such things as nickel, aluminum foil, vinyls, and polyethelene, for example, for many months. Frankly, I believe the situation is much healthier today than in September, 1941. The concept of isolationism, then widespread, is much narrower today and the concomitant attitude of self-righteous selfishness and resentment at so-called government "interference" in the conduct of business essential to the national security is not widely discernible.

Explains Present Situation

Let me explain. Today many of those things which pertain to military needs and which are not under a formal allocation agreement are receiving first preference in producer's plants. It is a more tenable situation than existed in 1941 under OPM when, whether deliberately or unknowingly, many producers expressed the understanding that the priorities system meant only that the government was establishing a schedule of urgency relating only to its procurements—that a material with a government priority had absolutely no preference or precedence over any purchase order which was not so documented. That reluctance—that resistance—that desire to operate on a business-as-usual basis — with a holocaust even then raging in Europe —was among the direct causes to the need for and the stringency of the drastic regulations later drafted, such as the Tool Steel Limiting Order and the famous M-21.

Wait a minute. I can blast but I can hand out the bouquets also. I am excepting the steel foundries generally from those criticisms just voiced. And I think I can speak with some authority there; I was with George R. Hocker in the Forgings and Castings Section of the Steel Branch in OPM and WPB before going to the Welding, Forging and Casting Section of the Navy's Bureau of Ships. I recall no serious complaints about any steel foundry and certainly no flagrant deliberate violations of the limiting orders.

Now, I'll toss another bouquet. Steel foundrymen were among the first of the industrialists to point out the need for increasing capacities and for modernizing the older plants. Much of the program was accomplished with investment capital; some was made by government loans to industry; some was the result of direct government financing and ownership. Many of these expansion and modernization projects were under way when the tank cast armor procurements hit first in 1941 and 1942.

Capacity today is far different from that of 1941. In 1941, as closely as I have been able to determine, the U. S. annual capacity in steel castings was about 2,000,000 net tons—today it may be estimated at 3,500,000 net tons. Admittedly these figures may be questioned as their authenticity depends on the accuracy of reporting of "captive" foundry capacities. Statistics for steel ingot capacity show figures of 81,600,000 and 100,600,000 net tons, respectively. In other words, while the basic steel industry was increasing about 25 per cent, the steel foundries were expanding some 75 per cent.

Your vitally needed help was not confined to physical expansions of capital equipment. Far-seeing foundrymen changed their ways and their methods, tried new practices, invented and built new equipment. The old way was no longer the best merely because it was the known way. Things were tried which a year earlier would have received but little comment, and that not too flattering. New melting practices, radical in their departure from custom and tradition, appeared. Melt shop combinations employing the use of cupola, converter and electric furnace were designed and built. Ladle and intermediate desulphurization and dephosphorization practices were developed. And, unless memory plays me false, the early efforts to speed up the boil by use of oxygen were made in a steel foundry, as well as the beginning of the use of inert gases for flushing the melt.

Foundries Experiment

Foundries tried things never before thought feasible or even reasonable. Many an iron foundry tried its hand at steelmaking. I know of one in particular which in less than a year after making the decision was producing good castings in 4140, 18-8, 30-15, and Nitralloy. And an unusual application, for an example of the foundryman's skill, was the development of centrifugally cast main propulsion shafting for naval vessels. Employment of this method obviously saved many man-hours of forging and hollow boring as well as decreased metal losses in turnings and borings.

There were, of course, some inequities in the rush of that early program and there were mistakes—errors of judgment and errors of omission—but there were certainly few errors of inaction or indecision! Some of the new expansions turned out to be unbalanced with respect to cleaning capacity or to finishing or heat-treating capacity, but the deficiencies were corrected.

I hope for one thing that we never are forced to return to any of the situations of those days when government price subsidies were needed. I hope we never again have to make the lower grades in arc furnaces, carbon steels in particular. The price subsidies permitted usually did not balance the excess costs involved. I well remember the pithy comment made by the president of one foundry. When told that his company had been given a government commendation for its excellent and valuable production achievement, he remarked, wryly, "wonder if there was a check attached."

Competent Foundrymen Needed

Not all of these inequities were occasioned by unfavorable price differentials. While it must be admitted that various government agencies persuaded some to accept orders for the type of castings for which they were not at all qualified, tonnage-hungry foundries solicited — yes, fought for—jobs which were totally beyond their technical ability or production capacity. In any industrial program which may come, any government allocation of capacity must necessarily be directed by competent production engineers — preferably qualified foundrymen—who can recognize the limitations of each and every foundry in every possible phase of its productive abilities. And you, too, have a very definite moral responsibility to the government, to the military, to the people, and to yourselves to similarly recognize your own limitations. Tonnage cannot be the sole measure for solicitation of business or acceptance of orders.

Now, many of my remarks may have led you into thinking that we are about to go under a wide and rigid system of governmental controls. I must not permit that impression to remain, for I do not know. That is something which only the President can say or possibly the National Production Authority through delegation of authority from the President. However, Secretary of Commerce Sawyer said recently there is no doubt that new economic controls will be placed on business. With the military situation as it is today, an

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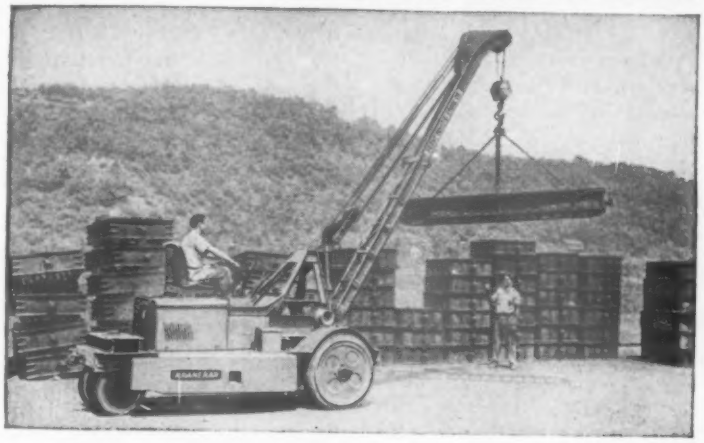

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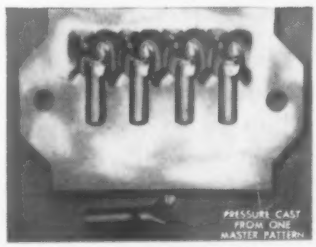
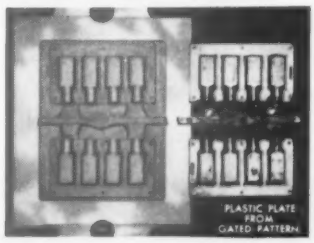


PRESSURE CAST FROM ONE MASTER PATTERN



PLASTIC PLATE FROM GATED PATTERN

orderly and reasonable administration of voluntary allocations may do much to obviate the necessity for arbitrary monitoring of production by government. I suspect, of course, that a few sales managers might even like to see strict controls so they can face customers complaining about delivery delays with a straight-forward look, saying with a note of sympathy, "Bill, there's no one I'd rather help than you but all our schedule is dictated by the government. Now, if you could get a AAA gold-plated priority, I think we might be able to slip you in ahead of the others."

And, on the other hand, I cannot argue too vigorously with those who are advocating some price controls, especially with scrap selling for $46 a ton, and pig at $45. However, even with ceilings on prices, there will probably always be someone desperate enough to pay illegal and unholy prices to someone greedy enough to indulge in double-dealing. Yet we must not have price controls without wage controls.

This year finds a product far superior to that of 1941. X-ray and gamma-ray inspection methods were available in relatively few foundries in 1941—now their use is rather general. Of course, military specifications requiring such examinations were frequently the incentives which "persuaded" you to acquire 1,000,000-volt x-ray equipment, etc. These past nine years have also seen wide adoption of other nondestructive testing methods—magnetic analysis, magnaflux, zyglo, supersonic.

Synthetic sands, core blowers, inorganic binders, better exothermic fluxes, all have helped advance the foundrymen's skill. Precision casting techniques, and vertical and horizontal centrifugal casting are finding more applications in military needs and are making better castings available more economically.

In stockpiling programs involving basic metallurgical needs, chromium, cobalt, manganese, columbium, tungsten and vanadium in particular affect the steel foundry. Only 5 per cent of the world's chromium is produced in the U. S. while 50 per cent is consumed here. Manganese figures are 5 and 30 per cent, respectively. We use 75 per cent of the world production of vanadium while producing 50 per cent; of tungsten we produce 25 per cent and consume 40 per cent. And when we review the statistics for cobalt and columbium, we see a more than grave problem, for we produce but insignificant amounts of these two metals and consume 50 per cent of the cobalt and 90 per cent of the columbium available in the world.

It is imperative that alternates and substitutes be developed for many of these alloying elements and that the most niggardly conservation methods be followed. If any use of them is but "desirable," it must be forgotten. We cannot afford to waste or misapply an ounce of any. Why are these so pointedly described? In every instance, that production which is outside the United States requires the sea lanes for transportation, and since their imported forms are mainly those of ores, concentrates or rondelles, air-lift operations—from New Caledonia, the Belgian Congo, India, the Gold Coast, or even South America—will not be practicable. And when we realize that considerable tonnages of some of these needs are coming from areas which may be enemy-held or whose peoples' political philosophies are sympathetic to the enemy, the gravity of the situation is more pronounced.

Prepare for War

Currently, we have probably the most complex military planning job of history. We must prepare for a war today with today's offensive and defensive weapons and simultaneously plan for a war tomorrow with offensive weapons which are only on the drawing board and with defensive measures against an enemy's weapons which can at the moment only be guessed at. We must plan concurrently to defend our shores and boundaries from attacks by land, sea and air, and to conduct operations under tropical and arctic weather—and no one knows which will be first and which will be worst.

The complexity of the military planning required is, of course, directly reflected in the complexity of industrial planning, especially in a system of free enterprise. Were we of a different political philosophy, the answer would be simple—there would be no civilian economy and no regard for any but the military. As it is, we are both keenly aware of the fact that we cannot convert overnight from a peacetime to a wartime economy. We can, however, plan for it. And the military has done much paper planning for the industrial mobilization which must accompany an all-out military mobilization.

Much of our planning for a next war was being started by the Military Departments while the past one was only seeing the beginning of the end. It was recognized that complete demobilization from the wartime pro-

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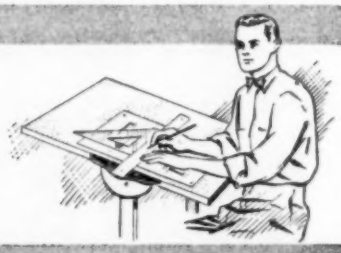

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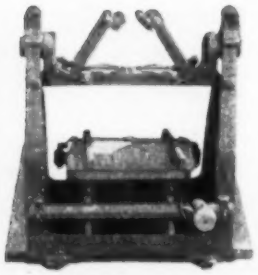

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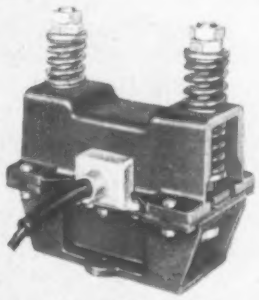

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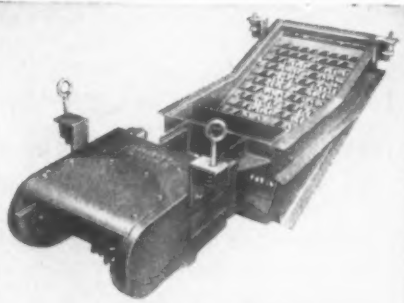

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duction system and the wartime industrial economy would be disastrous. Accordingly, a National Plant Reserve program was established, covering plants built by the government and held in reserve to preserve the industrial potential in certain areas of production. Steel foundries are in this category. Many of these plants are in use either by the Military Departments or by private producers. Others are strictly in a standby status maintained at the expense of the government. Many are covered by the National Security clause which requires that these plants be maintained by the owner or lessee in such condition that they can be reconverted to their original use within 120 days.

In addition to these plants, certain items of industrial equipment are in an industrial equipment reserves program, established to save for possible future utilization the war-produced industrial equipment which could not find an immediate use in the peacetime economy during the reconversion period. This reserve is in addition to those items of industrial production equipment which are part of the plants in the national plant reserve.

While it is a statutory responsibility of the military to prepare for the national defense, with respect to military mobilization and to industrial mobilization planning, preparedness is equally a responsiblity of industry and the man in the streets.

Answer Pertinent Questions

You should have detailed industrial mobilization plans of your own, if you do not have them already—plant-wide, company-wide, industry-wide. Let me give you a brief summary of a very few of the questions to which I think you should have the answers in a formal plan widely known to all of your key personnel. The plan, itself, by the way, although a formal document preferably, should not be static—it must be capable of constant review and change.

1. What amounts of what raw materials were used in the quarter of your maximum operations during World War II? What is your estimate of the same requirements for maximum operations now? What were, and are, your sources?

2. Is your power supply adequate for maximum operations? What is available as stand-by and as emergency power? Have you a mutual assistance agreement with nearby industrial activities?

3. What about steam and water, similarly? Fire protection?

4. Is your capacity balanced between melting, cleaning, heat treating and finishing? If not, have you

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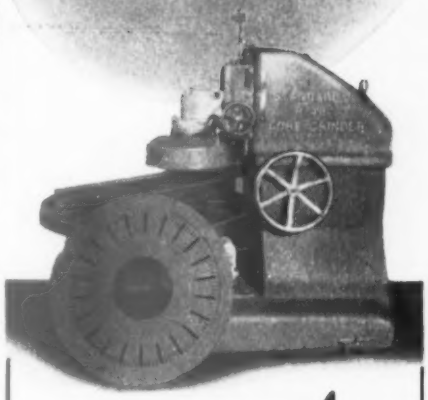

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provisional subcontract agreements with any nearby activity which can help?

5. Can you borrow or lend labor?

6. What about provisions for dispersal, if necessary?

7. What about plant security?

Obviously, the plan will include much more than the answers to these questions but can you answer them to your own satisfaction right now?

It may have seemed that I have been evading the issue. You all undoubtedly want to know what our actual requirements are today, will be tomorrow, next week, month, and year. Frankly, we don't know. The changing aspects of military operations and the every-dynamic concepts of military strategy require that logistics plans change almost as rapidly as tactical orders.

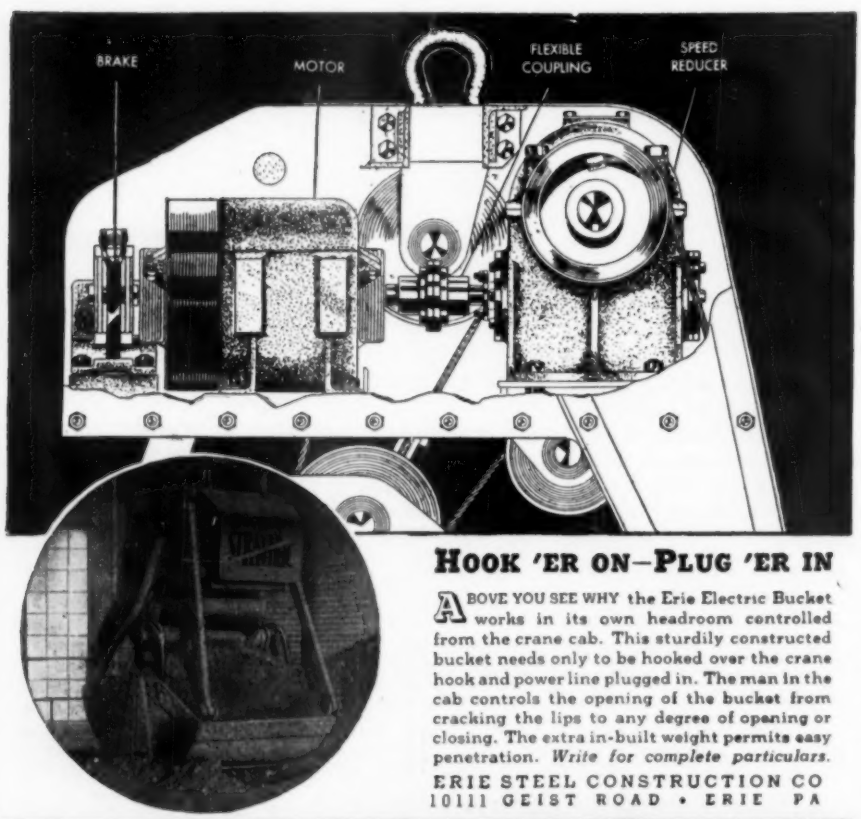
The program for the future is not immediately predictable. The President on July 24 asked the Congress for a supplemental appropriation of around $17 billion for the Department of Defense and for military assistance to other free nations. This was finally approved. Of this total, most is required for maintenance and operation of the current military activities, increased by the approved increase in the size of the military establishment itself. However, roughly $3.3 billion is earmarked for aircraft procurement. Tanks, guns, field artillery, electronics, and other major procurement items will get about $2.6 billion while ship construction is allotted $185 million.

As for the Navy, I expect no great procurement program involving new procurements of castings immediately. Thank heavens, we have a powerful reserve of naval power in our Atlantic and Pacific reserve fleets. Alterations and design changes which may attend activation probably will require some replacement of equipment and some new equipment. The Army's tank program is something else but I am not prepared to tell you for the Army to what extent cast armor will be required. Aircraft estimates are also out my bailiwick. Construction, machine tools, and replacement for many strategic industrial activities will continue to be good customers for a long time, I am certain.

It appears to be a safe estimate that the Korean supply needs have been accommodated almost exclusively from supply depot and supply center stocks. There have been procurements, particularly new ordnance items, especially for the current operations but the tonnage represented is probably not large in total and is actually slight with respect to new castings. Procurements to replace those items taken from stock are being made.

I believe it will not be necessary to initiate another broad expansion program for the steel foundries. The industry did a fine job in 1941-1945, and while plant modernization and plant improvement programs will always be under way, I do not expect that an overall capacity increase will be required. This, of course, is under study by the Munitions Board and the results of the survey recently made of individual companies will provide more of the answer. It is conceivable that considerable capacity devoted in 1941-1945 to heavy structural castings required for naval and merchant ship construction will be available for other heavy casting requirements. At any event, more efficient utilization of existing capacity will result from correction of past inequities.

To summarize, the military looks to industry for just about what it looked for in 1941-1945. Mundanely speaking, we can say that from the steel foundries we look for good castings, well made, at a reasonable price. Beyond that, the military looks to industry for conservation of critical materials, optimum employment of available manpower and total use of all its industrial skill and capacity. Ultimately, the military looks to industry for the same sort of joint operations that made V-E and V-J days possible.



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Conveyor Equipment Manufacturers Meet

L. B. McKnight, vice president, Chain Belt Co., Milwaukee, was elected president of the Conveyor Equipment Manufacturers Association at its seventeenth annual meeting, White Sulphur Springs, W. Va., Oct. 16. He succeeds John M. Alvey, president, Alvey Conveyor Mfg. Co., St. Louis.

Other officers elected are: Vice president, G. W. Ostrand, general manager, Caldwell Plant, Link-Belt Co., Chicago; treasurer, Earl D. Stearns, general manager, Conveyor Division, Barber-Greene Co., Aurora, Ill.; secretary, Lee Sekulski, sales manager, Mathews Conveyer Co., Ellwood City, Pa.

The following were elected to serve on the association's executive committee: J. E. McBride, vice president, Palmer-Bee Co., Detroit; J. A. Jeffrey, vice president, Jeffrey Mfg. Co.,

Columbus, O., and Merrill E. Pratt, president, Continental Gin Co., Birmingham, Ala.

R. C. Sollenberger was re-elected as executive vice president. The headquarters of the association under his direction are at 1129 Vermont Ave., N. W., Washington 5, D. C.

The need for increased mechanization to sustain present high wages in industry was emphasized by H. S. Hersey, president, C. O. Bartlett & Snow Co., Cleveland, who delivered the principal address at the convention.

L. B. McKNIGHT

Mr. Hersey said that mechanization of materials handling provides the greatest field for increasing efficiency in most industries. Studies by the Conveyor Equipment Manufacturers Association, according to Mr. Hersey, have shown that in the average industrial company materials handling accounts for one out of every three dollars of cost, and in many companies these costs can be cut in half by systematic modernization.

Mr. McKnight, the new president, has since 1946 headed the association's industrial promotion committee, and he has long been a leader in organized activities of the industry.

At the White Sulphur Springs meeting 28 companies in the industry were represented by more than 50 executives.

Gray Iron Research

Gray Iron Research Institute Inc., Columbus, O., has issued a booklet entitled "Gray Iron Research." It is a report of progress of the research program under the direction of Battelle Memorial Institute, Columbus, and a summary of the practical achievements in foundries which are members of the institute.

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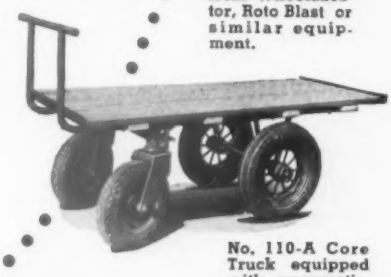

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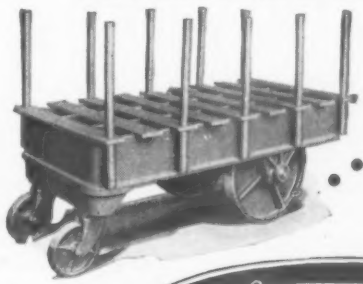

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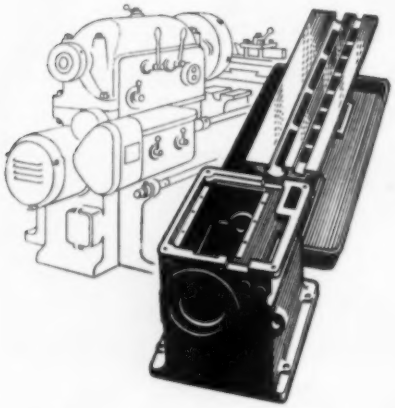

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F-12

Developing and Evaluating Cast Turbine Rotors

(*Continued from page* 93)

coupons were removed to obtain standard ¼-in.-diameter test bars. One half of each rotor was aged for 24 hours at 1350° F (722° C) and the other half was solution-treated for 2 hours at 2200° F (1200° C) and air quenched, then aged 24 hours at 1350° F (732° C) prior to removing the test bars.

The wheels were air cooled from 2200° F (1200° C) because it was found that 2250° F (1230° C) gave greater warpage during both heating and quenching. In the larger sections the benefits to be derived from water quenching were substantially diminished because of the poor heat conductivity of N-155. Accordingly, when preliminary tests showed that solution treatment at 2200° F (1200° C) followed by air cooling gave high values of rupture life at 1500° F (815° C), this treatment was selected as being the most practical.

Specimens were designated according to the location in the castings and the designations were kept the same for all five disks. The locations and corresponding designations are shown in Fig. 10. Specimens 1 through 6 were from the as-cast and aged half of the wheel, while 7 through 12 were from the hub section of the wheel and were tested at room temperature, while the other six were from the rim of the wheel and were tested in stress rupture at 1500° F (815° C).

Show Etched Structures

Figs. 11 through 15 show the etched structures of the five rotors tested. From the data accompanying the photographs it may be seen that for rotors cast in graphite molds, high pouring temperature tends to form a columnar structure even in the thin section, while a low pouring temperature increases the tendency toward a very fine-grained equi-axed structure at the wheel rim. For rotors cast in investment molds, higher pouring temperatures produce proportionately coarser grain sizes. From a study of a great many of the castings made, it is evident that pouring temperature has a much greater effect on the structure than mold temperature for the two mold materials used, as was anticipated from the work on cast ingot structures.

When casting into graphite at a low pouring temperature (1460 to 1500° C), (2260 - 2730° F), the metal first entering the mold is cooled considerably in flowing outward to the rim over the cooler graphite. This brings the metal uniformly to a low temperature just above the true melting point. As a result, a large number of nuclei are formed and a fine-grained equi-axed structure results in the very outermost rim. Somewhat closer to the hub and nearer to the pouring zone where the mass of metal is larger and where the entering metal is no longer cooled by contact with a cold graphite mold, (the first metal, in giving up its heat on the way out to the rim, heats the graphite near the hub) the nucleation rate is much less and nucleus formation at the metal-graphite interface proceeds normally. Due to the temperatures involved and the directionality of heat extraction the expected columnar structure results. (See Figs. 12 and 14.)

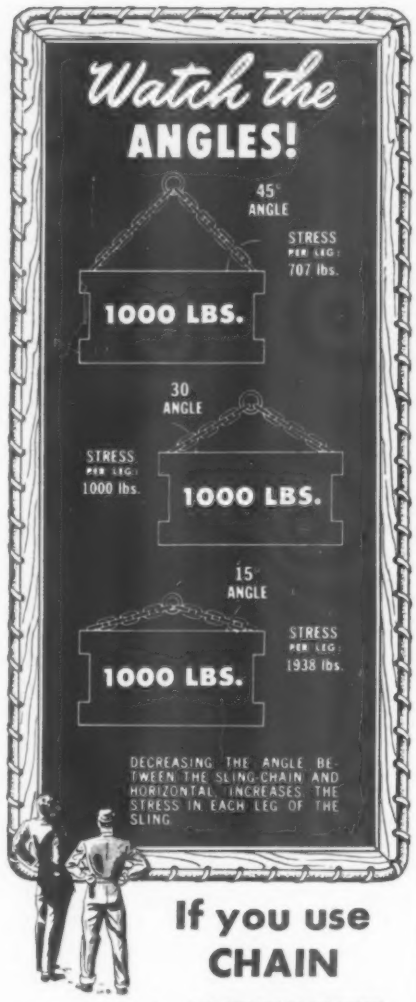
Metal Is Superheated

When the metal pouring temperature is higher than 1500° C (2730° F) (about 1525 to 1550° C), (2770-2820° F), the metal is superheated sufficiently to permit some extraction of heat from the metal flowing to the rim without dropping the temperature to the immediate melting point range. As a result, the first nuclei formed are at the graphite-metal interface and a columnar structure is formed. (See Fig. 13.) If a much higher pouring temperature were used, the value of "N," the nucleation rate, might be small enough to permit the formation of a coarse-grained equi-axed structure. See Figs. 11 and 15.

In general, test bars machined from the cast rotors show the same trend of stress rupture properties with respect to structure as did the specimens machined from the ingots, but there are a few exceptions that are difficult to explain.

It may be seen in Table I that for the as-cast and aged specimens, coarse-grained equi-axed structures have by far the shortest rupture life, while the columnar structures have the longest life. An exception is noted for the fine-grained equi-axed structure of heat No. 218, which shows disproportionately high values when compared with the results of the several hundred tests conducted. The ductilities were high for all as-cast and aged structures. The fine-grained heat No. 218 shows the highest ductility of all the structures tested.

The 1500° F (815° C) rupture properties of the solution treated and aged specimens show little variation with respect to structure. However, the coarse-grained equi-axed struc-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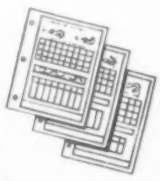

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tures are slightly inferior to the other structures in both ductility and rupture life. Again it should be cautioned that the rupture tests on the very coarse structure may not be entirely representative because of the use of ¼-in.-diameter test bars. It appears that solution treatment tends to reduce the effect of structure on the hot strength. This observation was supported to some extent by the tests performed for work described earlier. For heat No. 218 the as-cast and aged specimens are vastly superior to solution treated and aged ones. This is the only case where this has been observed. With the exception of heat No. 218, higher hot strength is developed by solution heat treatment followed by aging. This treatment reduces the ductility in all structures.

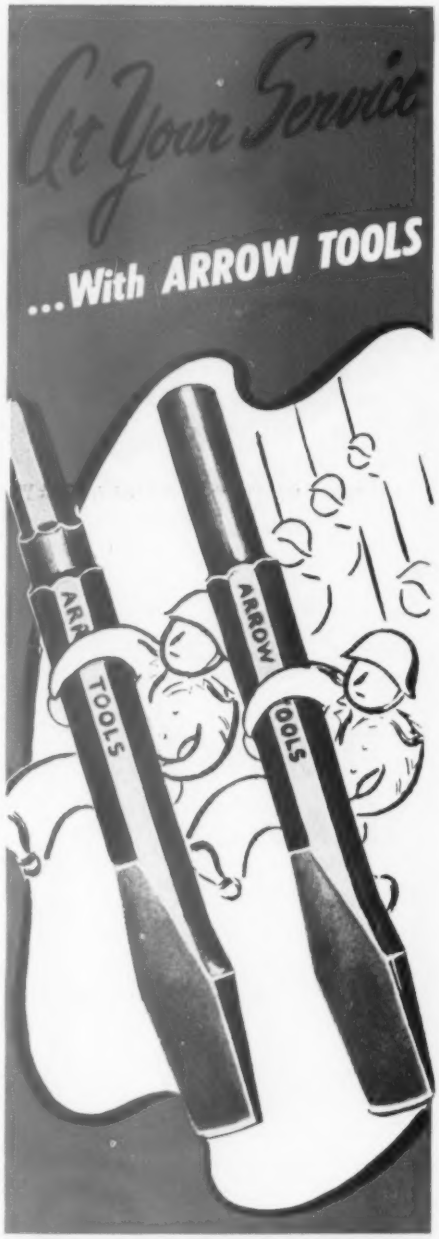
It was observed in the course of rupture testing that not only was there uniformity of test results, but no directional properties existed within the cast wheels which might have been attributed to the original location of specimens within the castings. This is true, of course, only for the tests in two dimensions (Fig. 10) since the third dimension (thickness) was not large enough to yield test bars.

Test Results Vary

Table II, summarizing the results of the room temperature tests, shows that for as-cast and aged specimens both the columnar and fine-grained equi-axed samples have appreciably higher tensile strengths, but about equal yield strengths compared with the coarse-grained equi-axed specimens. The ductility values for the as-cast and aged specimens vary from about 5 per cent reduction of area for coarse-grained heat No. 252 to 13 per cent for columnar heat No. 212.

Solution heat treatment followed by aging had the usual effect of increasing both the tensile and yield strengths over those for as-cast and aged specimens. The greatest increase in strength, due to solution treatment was exhibited by coarse-gained equi-axed heat No. 252. This may seem unusual since the other coarse-grained rotor, No. 208, showed a comparatively small increase. It may be seen by referring to Table II, however, that No. 208 contains about 10 to 12 points of carbon less than No. 252. These two heats represent the extreme in carbon content for the series of rotors tested.

It does not seem warranted to discuss casting No. 218 any further because it was the only heat of about 100 which did not perform



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within expected limits. The data quoted in Tables I and II are valid since there were three tests for each treatment which produced uniform results.

In summation, it can be stated that the properties of columnar and fine-grained equi-axed rotors are similar, and are superior to those of the coarse-grained equi-axed castings. This is in fair agreement with the conclusions of the work on ingots. Proper heat treatment improves the strength properties, both hot and cold, while reducing the hot, but not the cold ductility.

Solution Heat Treatment—Since it has been shown that solution heat treatment is important to bring out the best 1500° F (815° C) rupture properties and room temperature tensile strength, several additional tests were conducted to study the effect of solution time at temperature.

Solution times of ½, 2, 4, 8, and 16 hours at 2260° F (1235° C) were used on the cast structures, followed by aging at 1350° F (732° C) for 24 hours. Figs. 16 through 20 show the changes in structure which occur, and indicate the increase in rupture life. Fig. 16 shows preferential aging without solution treatment. Figs. 17 through 19 show that as the solution time at 2260° F (1235° C) increases from ½ to 4 hours the aging precipitate becomes more uniformly dispersed throughout the austenite matrix. Carbon diffuses from the massive carbides to react with chromium in the matrix to form Cr_4C, which is the aging precipitate.

Longer solution time permits greater, more uniform diffusion of the carbon which is then maintained in solid solution after quenching until it precipitates by aging as Cr_4C at 1350° F (732° C). After 16 hours of solution time, apparently higher carbon carbides dissolve, but due to a decreased concentration gradient the carbides precipitate in a narrow belt along the grain boundaries, giving a low rupture life and decreased ductility.

The changes described above are typical for all the grain structures, in that solution times of 2 to 4 hours result in important increases in rupture life at 1500° F (815° C). Figs. 21 through 23 show the changes which occur in rupture life at 1500° F (815° C) and hot elongation as a function of increasing solution time at 2260° F (1235° C) for all the grain structures.

In Fig. 23 it is important and interesting to note that the ductility of the columnar structures increases appreciably as the rupture life increases with increasing solution time up to 4 hours. The other structures show either a loss of ductility or a very small improvement.

For practical purposes, it appears that a solution treating time of 2 hours would be sufficient, although maximum rupture life is developed at about twice that time for a solution temperature of 2260° F (1235° C). Although all the test specimens discussed in this portion of the report were water quenched from the solution temperature, it seems adequate to air quench in the case of a large piece, such as a turbine rotor, as was described previously.

It should also be pointed out that a temperature lower than 2260° F (1235° C) is more desirable from the practical viewpoint. A temperature as high as 2260° F (1235° C) is close to the melting point of the carbide phase of N-155, and there is danger of overheating unless excellent furnace control is maintained. It is suggested that a temperature of from 2180° F (1195° C) to 2200° F (1205° C) be used for about two hours, followed by air quenching and aging for about 24 hours at 1350° F (732° C) if the optimum properties of this material are to be obtained in rotor form.

General Conclusions — It is considered that certain broad conclusions can be drawn on the basis of this work in addition to the specific ones already stated.

It has been pointed out earlier that an all-columnar structure is the most desirable from the standpoint of hot and cold strength as well as ductility. It was comparatively difficult to obtain this structure in the type of rotors cast, particularly in the thin section, using the equipment available. It was found that a hot pour of about 1550° C (2820° F) but no lower than 1525° C (2780° F) was necessary to obtain such a structure in a graphite mold of the dimensions used. This was difficult because of the limitations on moving comparatively large amounts of molten metal into the pouring position with hand equipment. A full size foundry with equipment capable of transporting the molten metal rapidly from furnace to mold could pour castings from the temperature range suggested and consistently obtain a columnar structure without any great difficulty. It seems practical to apply this information to the production of cast rotors if proper controls are exercised.

The problem of obtaining a satisfactory surface on a casting poured in a graphite mold has not been solved. The mold washes tried were

unsuitable since none of the castings made had a usable as-cast surface. Some of the washes reduced the difficulties caused by metal splashing as well as the oxide wrinkling effect resulting from rotation of the mold. It is therefore suggested that subsequent castings of this type be made oversize so that they can be machined to final size.

Castings made in refractory molds will yield improved surfaces, but may still require some conditioning to be acceptable. The upper limit of regular investment castings appears to be about 100 pounds. A superior refractory combination must be developed to overcome this limitation. At the present there is some doubt that the coarse equi-axed grain structures which would be obtained from castings made in refractory molds will be useful in service applications. However, this can only be determined by means of hot spin or service tests.

Yields High Values

It is recommended that the N-155 rotors be solution treated regardless of structure. Two hours at 2200° F (1200° C) followed by air cooling and aging at 1350° F (732° C) for about 24 hours will yield high values of room temperature tensile properties as well as high values in rupture tests at 1500° F (815° C).

Even though the rotors cast in investment molds exhibited properties generally inferior to those cast in graphite, several interesting problems were encountered and techniques for their solution were evolved in this work. The actual production of a sound investment mold casting required considerable experimentation. It was found impossible to feed a casting of this size properly in a low-conductivity mold of the investment type. Heat flow through the walls of the mold was so slow that even an 8-in.-tall large-diameter hot-top solidified improperly and stopped feeding molten metal before the heavy center section of the casting had solidified. This resulted in a large shrinkage cavity at the junction of the hot-top and the hub section of the rotor.

The use of several hundred grams of a commercial thermite mix, in place of a large hot-top, resulted in a perfectly sound casting and a saving of about 12 pounds of metal in a 40 pound melt. The thermite was added in increments after pouring the casting, thereby causing molten metal to feed into the critical area until the heavy section had solidified. It appears that it is impractical to feed a mold of this type and obtain a sound casting by use of means other

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It may be noted that tests were conducted on N-155 with variations in carbon content from about 0.085 to about 0.30 per cent. In general, it is evident that the hot strength increases with increasing carbon content as shown by a comparison of high and low carbon specimens in the bar graphs, Figs. 2-5. The maximum usable carbon content has not been determined in this investigation, but on the basis of previous related work it is reasonable to expect an increase in strength of rotors cast with up to 0.30 per cent carbon. It would be expected, however, that if the carbon content was too high, the ductility would decrease, thereby leading to embrittlement, particularly at room temperature.

As a final indication that cast disks have useful properties comparable in most respects to the forged product, the accompanying table compares the properties of a low-carbon forged N-155 disk,[2, 3] and the properties of cast N-155 in the fine-grained equi-axed condition (FGEA) and in the columnar grain condition.

Disk Condition	Solution Treatment	Aging	Hours Rupture Life at 20,000 psi & 1500° F (815° C)	Per Cent Elong.	Per Cent R. of A.
Forged, low carbon (0.15%)	Hot-cold worked	2 hr, 1200° F, strain relief	100	7 to 20	16
Forged, low carbon	2200° F W.Q.	24 hr, 1350° F	60	40	50
Forged, low carbon	2200° F W.Q.	24 hr, 1500° F	50	40	55
Forged, low carbon	As forged	.....	28	10 to 15	30
Cast, high carbon (0.25%) columnar	As cast	24 hr, 1350° F	104	14	42
Cast, high carbon FGEA	As cast	24 hr, 1350° F	68	24	25
Cast, high carbon FGEA	2200° F Air Q.	24 hr, 1350° F	130	8	11

			Tensile Strength (psi)	0.2% Yield Strength (psi)	Per Cent Elong.	Per Cent R. of A.
Forged, low carbon (0.15%)	Hot-cold worked	2 hr, 1200° F	120,000	73,000	32	50
Forged, low carbon	2200° F W.Q.	24 hr, 1350° F	106,000	52,000	34	30
Forged, low carbon	2200° F. W.Q.	24 hr, 1500° F	110,000	61,000	17	19
Forged, low carbon	As forged	.....	118,000	66,000	45	50
Cast, high carbon (0.25%) columnar	As cast	24 hr, 1350° F	98,000	57,000	8	10
Cast, high carbon, FGEA	As cast	24 hr, 1350° F	90,000	50,000	7	7
Cast, high carbon, columnar	2200° F Air Q.	24 hr, 1350° F	115,000	74,000	9	10

The comparison is not entirely valid because of the difference in carbon levels, but is of great significance. Since high-carbon forged disks are extremely difficult to make in N-155, the low carbon grade is preferred. There are values available for comparison in several conditions of heat treatment. The maximum rupture life is 100 hours at 20,000 psi and 1500° F (815° C) with reasonably good ductility. The cast high carbon (0.25 to 0.30 per cent) disks show about 130 hours, also with reasonable ductility in the solution treated and aged condition. At room temperature the forged low-carbon disk shows a tensile strength of up to 120,000 psi compared with the best average value of 115,000 psi for the columnar structure in the cast wheel. The maximum yield strength values at 0.2 per cent offset are about the same for the forged and cast grades. The ductility is definitely greater in the forged wheels, but the cast wheels after aging still show 7 to 10 per cent which is greater than was available in early Timken wheels and still meets one of the requirements which places 7 per cent as the minimum value.

In an alloy system of the face centered cubic type, it was found that when grain structure is controlled, the variation from wheel to wheel or within any one cast wheel is small in tests taken from different portions of the wheel.

Six controlled structure wheels have been cast and treated and have been examined for defects. These six wheels are ready for hot spin tests which are now being conducted.

Finally, it appears that castings hold considerable promise for jet engine and gas turbine rotor applications. Castings, in addition to offering good physical properties, present a means of manufacturing rotors cheaply and alleviating a production bottleneck. A wider field of investigation should be covered to develop casting methods and mold materials for producing superior properties in cast rotors of various alloy compositions, since the work was restricted to only one alloy.

Acknowledgment — The authors wish to acknowledge gratefully the

support of the Bureau of Ships who sponsored the research under contract NObs 25391, Task No. 4, Section 1773.

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Foundry Workers' Earnings Rise

Average earnings of coremakers and molders in the summer of 1950 ranged from $1.15 to $2.03 an hour in 22 leading ferrous foundry areas, according to the Bureau of Labor Statistics, U. S. Department of Labor, Washington. Machine molders generally earned more than bench and floor molders. This is attributed in part to incentive systems in machine molding, a process widely used in production foundries.

Wood patternmakers formed the highest paid group among the occupations studied. Their hourly earnings averaged from $1.75 an hour in Milwaukee to $2.32 in Los Angeles.

Earnings of ferrous foundry workers were highest in the Great Lakes region, which accounted for half of the total employment in the areas studied. Detroit was the leading area in five of the eight selected occupations. The Pacific coast ranked next to the Great Lakes region and recorded the top earnings levels in two occupations.

Comparisons of current earnings with those reported in a similar study in June, 1949, showed that increases had occurred in most jobs. Area averages typically increased 1 to 5 per cent.

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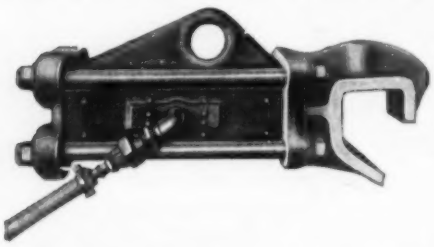

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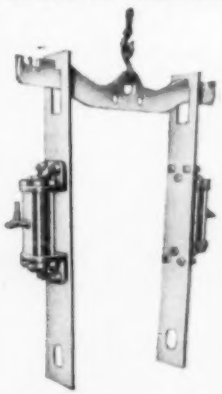

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NEW HAVEN, CONN.

With the EDITORS

NEW RUFFLES: Your January issue of FOUNDRY will look a little different. For some time the editors have been planning a number of additions and changes which they believe will provide an even greater service to the foundry industry. When your January FOUNDRY arrives just before the new year, you will find that it has a new type of cover; a new spot news section to give you the latest information on developments in Washington and other centers which will affect your business; a new feature to give you younger men some of the important fundamental information on foundry practice; and a change in the general appearance of the feature section and regular departments. We feel sure that you will like it.

—o—

Pinking Shears: While visiting in New York a few weeks ago, the editor dropped in on Don Reese at the offices of International Nickel on Wall Street. Don had a few pairs of pinking shears made from two ductile iron castings produced by the Acme Shear Co., Bridgeport, Conn. We managed to snag one pair, and while we still have them on our desk as an interesting end product of ductile iron castings, there seems to be some pressure from the home front to put these shears to the practical use for which they were designed. In passing we want to report that the castings are excellent, and we understand provide fine competition from the quality, appearance and price standpoint. May we offer congratulations to E. J. Laufer, foundry superintendent of Acme Shear for producing these fine castings.

—o—

A Bull: Did you notice the recent advertisement of the Borden Co. in Fortune entitled "Ever think you'd be found in a foundry?" asked Elmer, the Borden Bull. Well, we have seen lots of bulls in the foundry—now we know "Where's Elmer?"

—o—

With an Elastic Top: One more report should be made on the vacation trip of Mr. and Mrs. Editor. We were coming back from the Basin Harbor Club, located a few miles west of Virgennes, Vt., and were traveling south on U. S. 7. A little beyond Manchester, Vt., we stopped at an interesting looking antique shop near the town of Sunderland. Conversation about some old castings in the shop brought out the fact that the proprietor was A. Gale Johnson Jr., grandson of the founder of the old Isaac G. Johnson & Co., Spuyten Duyvil, N. Y., and son of the foundry superintendent of that establishment. The A. Gale Johnson that we found in this beautiful Vermont spot served his apprenticeship as a molder and then as a patternmaker and was assistant to his father at the time the foundry was taken over by the City of New York in 1924 so that a canal could be built through the property. Mr. Johnson evidenced interest in a copy of The FOUNDRY, and we found

John Sharritts, foundry superintendent, Westinghouse Electric Corp., Cleveland, and Mrs. Sharritts (second and third from left), personally conducted the editor through the Lighting Division plant at the open house Oct. 28

he wanted to consult the advertising pages to find a manufacturer of molder's shoes (with elastic tops). That desire was fulfilled. Foundrymen traveling U. S. Route 7, below Manchester will find Mr. and Mrs. Johnson very interesting people, and the antique shop well worth a visit.

—o—

Thanks So Much: We noticed the following item in "Advertising Highlights," published by Geo. L. Kinter, Pittsburgh, under the heading "Brown Goes to Work."

"In the September issue of The FOUNDRY, interesting and practical use of brown is made. On a page of Carborundum, the background is an excellent reproduction of that abrasive material. On an editorial page, a halftone view of an exhaust system is printed in brown and over it is a line of diminishing dots in black to show the direction of the air-flow. On another page carrying four halftones, one of them is in brown and two of the small Gothic captions are run over a sepia tint. Better trade publications are surely using ingenuity and skill in their make-ups." Thanks to A. D. Walter, editor of the particular column in which this item appeared, for the kind implication in the last sentence.

—o—

Travel: The editors are looking forward to the Christmas holidays as the one event that will permit them to spend a week at home. Since our last report, Bill Gude attended the New England Regional at Boston and the November meeting of the Society of Business Paper Editors in Washington. Erle Ross attended the annual meeting of the National Foundry Association and the annual dinner of the Meehanite group in Chicago. Ed Bremer tramped the big exihibit of the National Metal Show in Chicago, visited plants in St. Joseph, Mich., and covered the Michigan Regional Conference in Lansing. The Editor attended the Metal Show, spoke in Reading, Pa., before the Reading and Conestoga foundry groups, attended the Foundry Industry Technical Sub-Committee to the Munitions Board meeting in Washington, covered the Purdue Regional Conference, sat in on one session of the Steel Founders Society Technical and Operating Group Conference in Cleveland, and attended a special party of the Whiting Corp. in Chicago.

—o—

Holiday Greetings: All of us in the editorial and business departments, want to take this opportunity to wish every reader a very Merry Christmas and a New Year filled with Peace and Happiness.—F.G.S.

Brinell Testing

at PRODUCTION LINE SPEEDS

Simply set tolerance hands on the lower dial of this Brinell Hardness Tester to the desired limits and the operator merely notes that the indicator points stop within them.

No grinding or preparation of parts is necessary. Foot operation permits free use of both hands. Tests are completed as rapidly as the operator can handle the parts.

Standard Brinell test loads are used . . . machine is motor-driven . . . loads are applied hydraulically . . . round and flat parts are handled equally well.

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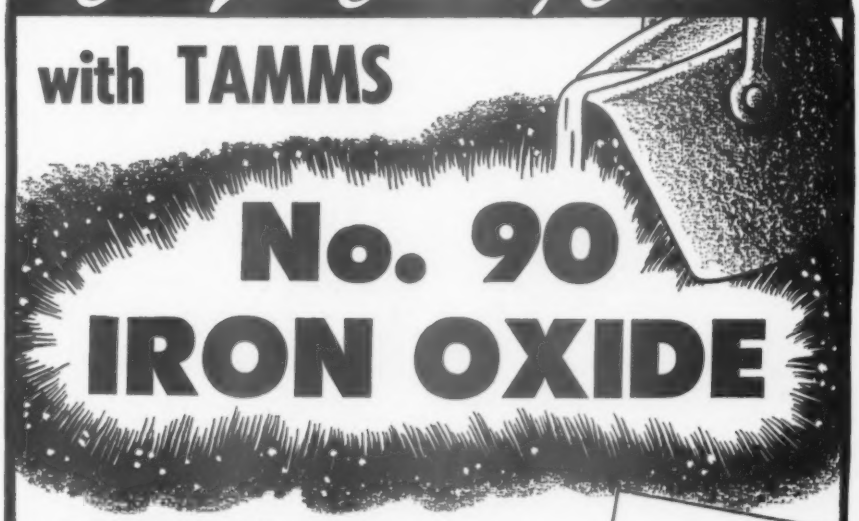
WRITE FOR LITERATURE

DETROIT TESTING MACHINE CO.
9390 GRINNELL AVENUE • • • DETROIT 13, MICH.

Cut Your Cleaning Costs...
with TAMMS



No. 90 IRON OXIDE

TAKE A TIP...
from many of the nation's largest grey iron and steel foundries . . . use TAMMS No. 90 IRON OXIDE. You will get better, cleaner, higher quality castings . . . you will reduce cleaning costs . . . you will prevent core burning, veining, penetration. If you haven't already tried TAMMS No. 90 . . . write today . . . we will gladly send you a SAMPLE!

TAMMS INDUSTRIES, INC.
(formerly Tamms Silica Co.)
228 N. La Salle St., Chicago 1, Ill.

NO DELAYS! IMMEDIATE SHIPMENT ASSURED!

7 WAYS SAND CONTROL SAVES MONEY

Use NEWLY DEVELOPED TEST VALUES

1 EASIER MOLDING

Green Strength
Green Deformation
Flowability
Moisture
Rammability

2 EASIER CORE MAKING

Green Strength
Blowability
Sagging Resistance
Cracking Resistance
Stickiness
Moisture

3 BETTER MOLD CONDITION

Green Hardness
Air Set Strength
Dry Strength

4 BETTER CORE CONDITION

Dry Hardness
Core Strength
Core Deflection
Moisture Absorption
Gas Pressure

5 CASTING APPEAL

Permeability
Clay Substance
Fineness
% Combustible

6 CASTING QUALITY

Hot Strength
Hot Deformation
Expansion
Spalling

7 EASIER SHAKE-OUT

Retained Strength

Write for Free New "Foundry Sand Practise" Book

CONTROL EQUIPMENT

HARRY W. DIETERT COMPANY

9330 ROSELAWN • DETROIT 4, MICH.

...TRADE PUBLICATIONS...

For More Details on these Items Use Reply Card—Page 217

CRONING PROCESS: Bakelite Division, Union Carbide & Carbon Corp., 300 Madison Ave., New York 17—Booklet contains fundamental information on the Croning process intended to aid those interested in evaluating possibilities of the process for use in their foundry. It also describes company phenolic resins used in making molds and cores by the process.
For More Details Circle No. 90—Page 217

FLUORESCENCE DETECTOR: Menlo Research Laboratory, P. O. Box 522-DB, Menlo Park, Calif. — Folder 4S-5/50 describes an ultraviolet light source with inbuilt dark chamber to make possible fluorescence detection and comparison in daylight. One of its uses is in nondestructive material testing with glow techniques.
For More Details Circle No. 91—Page 217

ROTARY PUMP: De Laval Steam Turbine Co., 853 Nottingham Way, Trenton 2, N. J.—Bulletin L 313-A-B describes a screw-type rotary pump designed for pumping petroleum products and other light or viscous fluids as required for rotary and steam atomizing oil burners, oil transfer, lubrication, hydraulic systems and similar services.
For More Details Circle No. 92—Page 217

ABRASIVE WHEELS: Charles H. Besly & Co., 118 North Clinton St., Chicago 6—Catalog includes tables of peripheral speeds at various revolutions per minute, maximum peripheral speeds for resinoid bonded abrasives, grades and markings, and a brief summary of the merits of resinoid bonds.
For More Details Circle No. 93—Page 217

PLANT SANITATION: G. H. Tennant Co., 2530 North Second St., Minneapolis — Illustrated booklet, "New Ideas on Plant Sanitation and Maintenance," is a reprint of an address by J. Lloyd Barron, C. E., sanitation department manager, National Biscuit Co., N. Y. Booklet contains a question-and-answer section.
For More Details Circle No. 94—Page 217

CRANE SCALES: A. H. Emery Co., 682 Main St., Stamford, Conn.—Bulletin 501, replacing previous data sheets, brings up to date and consolidates information on the use, advantages and construction of company's hydraulic crane scales for measuring loads while in transit.
For More Details Circle No. 95—Page 217

WHEELS AND CASTERS: Kilbourne & Jacobs Mfg. Co., Box 177, Columbus 16, O.—Catalog 117 covers plastic, solid rubber, iron and demountable disk wheels, in hard and cushion, solid tread, semipneumatic and pneumatic rubber tire models, with plain, roller, ball and tapered rolling bearings, in capacities of 140 to 6500 lb.
For More Details Circle No. 96—Page 217

ELECTRIC PUMPS: Allis-Chalmers Mfg. Co., 1032A South 70th St., Milwaukee—Bulletin 52B6140B covers design and construction features of a close-coupled pump and motor. Pumps are rated from 10 to 500 gpm at heads to 220 ft. Motors are rated from ¾ to 10 hp.
For More Details Circle No. 97—Page 217

PHOTOELECTRIC EQUIPMENT: De-Tec-Tronic Laboratories Inc., Dept. C, 1227 North Clark St., Chicago 10—Catalog 550 features photoelectric equipment and accessories for production control, counting, boiler and ventilating smoke detectors, burglar and warning devices.
For More Details Circle No. 98—Page 217

TECHNICAL SERVICES: Sam Tour & Co., 44 Trinity Pl., New York 6—Brochure portrays the work of company scientists, engineers, consultants and laboratories in performing technological, engineering and research services.
For More Details Circle No. 99—Page 217

PAINT: U. S. Stoneware Co., P. O. Box 350, Akron 9, O.—Bulletin 712 on corrosion-resistant paint tells where and how to use it and where not to use it. Corrosion-resistant tables, based on field experience, are included.
For More Details Circle No. 100—Page 217

CARBON BLACK DISPERSIONS: Acheson Colloids Corp., Dispersed Pigments Division, 420 Lexington Ave., New York 17—Brochure summarizes technical data and operating suggestions on concentrated carbon black dispersions.
For More Details Circle No. 101—Page 217

CONVEYORS: Stephens-Adamson Mfg. Co., 100 Ridgeway Ave., Aurora, Ill.—Volumes 192 and 193 of the company's house magazine illustrate and describe installations of company conveying equipment in various plants.
For More Details Circle No. 102—Page 217

PREPAINT CLEANER: Oakite Products Inc., 157 Thames St., New York 6—Folder describes a prepaint metal-cleaning material formulated to remove oil and rust and to prepare metal for paint adhesion.
For More Details Circle No. 103—Page 217

CORE OIL: Archer-Daniels-Midland Co., Werner G. Smith Co. Division, 2191 West 110th St., Cleveland 2—Folder discusses a series of new core oils.
For More Details Circle No. 104—Page 217

AMASTEEL.....!

For low cost cleaning

- AMASTEEL is the blast cleaning material that is engineered for the job.
- AMASTEEL assures the lowest cleaning cost.
- AMASTEEL lasts many times longer. Investigate!
- AMASTEEL provides peak efficiency in shot for blast cleaning and peening. Developed by the maker of "PEENBLAST", "CLEANBLAST" and "ALLOY 99".

Abrasive for any and all kinds of work.

PRODUCERS OF
PEENBLAST
CLEANBLAST
ALLOY 99

ALLOY METAL ABRASIVE CO.
311 WEST HURON ST. ANN ARBOR, MICH.

"OLIVER" 30-inch BAND SAW
for smooth, accurate work in the pattern room

This sturdy motor-on-shaft "Oliver" Band Saw is the finest of its size built. Has large capacity under the guide. Note these features:

- Upper wheel has automatic brake
- Shut-off foot brake for lower wheel
- High - speed disk wheels mounted on ball bearings
- Self - locking table tilts 45° to right and 10° to left
- Efficient dust - collecting system
- Heavy one - piece frame
- New frictionless type saw guides
- ***Write for Bulletin***

OLIVER MACHINERY COMPANY
Established 1890 GRAND RAPIDS 2, MICHIGAN

AIR GUNS
that last and last and last!

Air-O-chek The Valve with the internal fulcrum lever

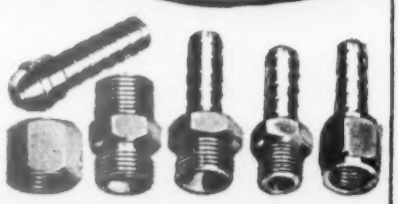
An invention in valve means

Streamlined Assembly. Air-O-chek Air Gun and standard pipe fitting ferruled to hose.

Ingenious lever arrangement makes conventional packing stem and gland unnessary.

Used in leading foundries and machine shops.

See your jobber or write direct for full details

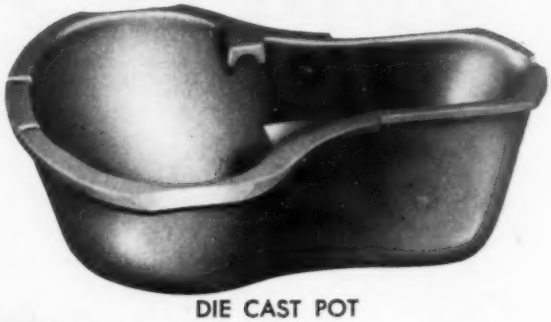


AIR-WAY PUMP & EQUIP. CO., 1058 N. Kilbourn Ave., Chicago 51 Ill.

MELTING POTS—Ingot Molds

FOR NONFERROUS METALS FROM ACME SPECIAL FORMULA

SPOUT POT
NO. 550A



DIE CAST POT

HOLDING BOWL
NO. HP7001

WRITE FOR
SCHEDULE OF 40 SIZES

ACME FOUNDRY COMPANY

2502 22nd Street **DETROIT 16, MICH.** *Phone:* Tashmoo 5-2404

Master Power

HARD CHROMED • PORTABLE PNEUMATIC TOOLS

DO MORE WORK AT LESS COST

because they deliver more power per cubic foot of air consumed, are light in weight for easier maneuverability and they retain their new tool power longer.

ARE PREFERRED BY OPERATORS

because they are lighter in weight, better balanced and designed to reduce shock and be free from vibration.

IF YOUR PROBLEM INCLUDES

chipping, ramming, grinding, buffing, sanding or wire brushing, *write us today for full particulars.*

THE MASTER PNEUMATIC TOOL COMPANY, INC.
ORWELL, OHIO • U. S. A.
SALES • SERVICE • STOCK • COAST TO COAST

Precision

CORE BOX VENTS

Here's part of a complete line of DEMMLER core box vents—rigidly constructed in varying sizes of slotted brass—slotted steel—and screen mesh. Orders filled promptly from stock.

BRASS SLOTTED CORE BOX VENTS
Slot widths: .010", .013", .015"
Diameters: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4", 7/8", 1", 1 1/4", 1 1/2"

STEEL SLOTTED CORE BOX VENTS
Slot widths: .010", .013", .015"
Diameters: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4", 7/8", 1", 1 1/4", 1 1/2"

SCREEN TYPE CORE BOX VENTS
Mesh: #30, #40, #50.
Diameters: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4", 7/8", 1", 1 1/4", 1 1/2"

SPECIFICATION CIRCULAR ON REQUEST

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CMD FOUNDRY SPECIALTIES

CMD PNEUMATIC CORE BARROWS
With single or double wheels

CMD WOOD FLOOR FLASKS
All sizes and shapes

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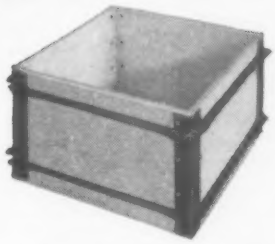
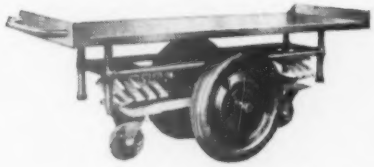
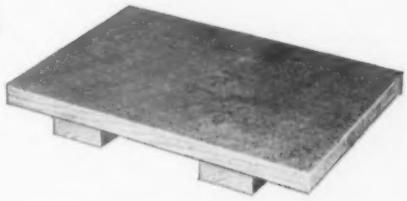
Cools, cleans and dries the air in one operation. *No moving parts.* Saves air tools. Nothing to replace.



CMD NON-WARP, NON-BURN SLIP JACKETS



CMD PNEUMATIC CORE TRUCKS
Minimize core chafing and breakage



CMD WOOD BOTTOM BOARDS
All sizes and shapes

WRITE TODAY for free copy of illustrated catalog on CMD foundry equipment and specialties, including complete specifications and price lists.

CHICAGO MANUFACTURING & DISTRIBUTING CO.
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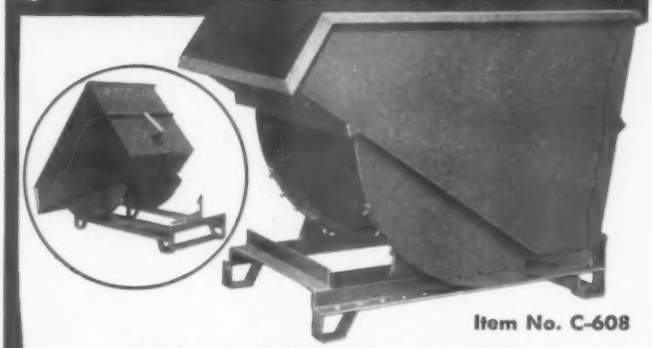
COMPLETE *NEW* DESIGN

P-S Automatic END DUMP
For Use With Lift Truck



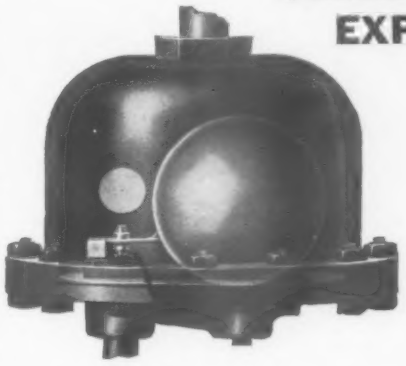
Item No. C-608

Speed up production, save man-hours with our new designed end dump, featuring simpler dumping by a smooth-operating rocker geared to track. Locks during loading by safety latch. Can be built for lift or fork truck or with casters that provide easy moving around machinery and through narrow aisles. Ideal for handling and dumping sand, castings, scrap, stampings and other heavy materials. Fits any fork or lift truck. All-welded construction. Built of heavy steel plate reinforced with heavy angles. Three standard sizes—½ yard, 1 yard and 1½ yards.

DESIGNED AND MANUFACTURED BY

Palmer-Shile Co.
16033 Fullerton Ave., DETROIT 27, MICH.

PREVENT COMPRESSED AIR STORAGE TANK EXPLOSIONS



DELIVER AIR CLEAN AND DRY

INSTALL A MURPHY TANK TRAP

Automatically removes all condensate (water and oil). Leak-proof. Requires no attention, no maintenance. Install it . . . and forget it. Alternate inlets for cramped space installations. Ideal for garage, service station and similar installations. Priced within reach of the smallest compressed air user.

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to perform as advertised or money refunded

Write for literature and price.

Or Send **Quickmail Coupon "24."**

GUARANTEED COMPRESSED AIR PRODUCTS

AFTERCOOLERS • SEPARATORS • STRAINERS • TRAPS
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JAS. A. MURPHY & CO.
FIFTH AND VINE STREETS, HAMILTON, OHIO
Moisture Elimination Up To 3000 Pounds Per Square Inch

Here is a chronology of

RADIUM RADIOGRAPHY *that will greatly interest manufacturers of steel castings:*

1930— First commercial use of gamma rays; radiograph made of sternpost of cruiser "Chester".

1935— First purchase of radium for industrial radiography by Westinghouse; bought from Radium Chemical Co., Inc.

1938— AFA questionnaire revealed that 8% of steel casting men used radium radiography.

1941— 22% of steel casting men bought, rented, leased or employed radium for radiographic purposes.

1946— 150 steel foundries rented or leased radium.

1948— 200 steel foundries rented or leased radium.

PORTABILITY
SIMPLICITY OF OPERATION
SIMPLE APPARATUS
MAY BE BOUGHT,
RENTED OR LEASED.

The swing to radium radiography is not accidental: it is a deliberate move by steel casting people who want to improve their production and effect economies. The apparatus is absurdly simple, requires no special training to operate, and, most important, involves no capital expenditure. Illustration shows a large number of castings being radiographed simultaneously. The apparatus may be bought, leased or rented. This is a sound, commercial proposition, and you really owe it to yourself to investigate our claims. Write today for additional information.

RADIUM CHEMICAL CO., INC.

570 Lexington Ave., N. Y. (22) N. Y. Chicago: Marshall Field Annex Bldg.
3723 Wilshire Blvd., Los Angeles 5, Cal.

No. 4 DAYTON RING VALVE BENCH RAMMER

MORE POWER—MORE SPEED

You'll get more production with these faster, more powerful rammers and at the same time substantially reduce maintenance costs.

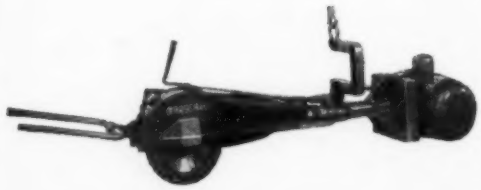
The Valve Units will last for years. The Cylinder Bores and Piston Rods are HARD CHROME PLATED which doubles the life of the Rammer. Many of the largest foundries in the country have already adopted them as standard. Made in six sizes to meet every requirement.

Send for Bulletin 300

DAYTON PNEUMATIC TOOL CO.

Manufacturers of Pneumatic Tools Since 1903

DAYTON, OHIO



MARSCHKE SWING FRAMES ARE DIFFERENT!

Size for size, Marschke Swing Frame Grinders are *heavier* than any other machine on the market. This extra weight is no accident—it's there—in the right places—to eliminate *vibration*, the "wheel eater". Marschke swing frames give you better two-way balance . . . smoother spindle rotation: bearing seats are *precision ground and honed* to assure perfect spindle alignment and bearing fit.

These are only a few reasons why Marschke grinders are the best money can buy. An inquiry will bring you interesting data.

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AMERICAN ABRASIVES
Clean Faster

You're assured *fast* cleaning when you specify American. Our own manufacturing process assures uniform hardness and size. Extra-tough American cleans faster, better than ordinary abrasives. Get efficient, low-cost cleaning in your plant . . . order American today in the 100-pound bags, all sizes graded to S.A.E. specifications.

Magnified 40 times, this photograph shows the uniform quality of American Shot and Grit . . . your best buy for economical blast cleaning.

AMERICAN SHOT & GRIT **THE AMERICAN STEEL ABRASIVES CO.**
GALION, OHIO

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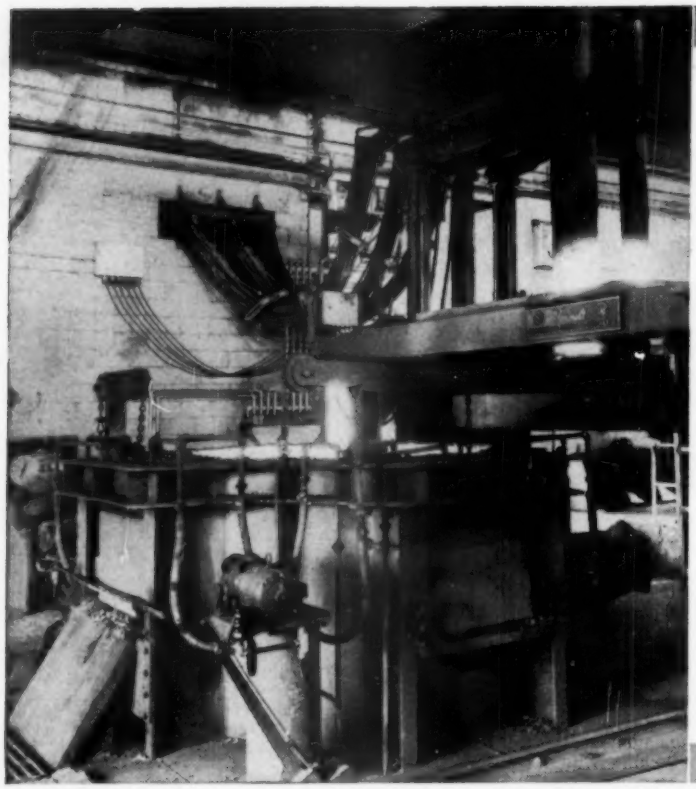
Quantity PRODUCTION *of* GREY IRON CASTINGS

ONE OF THE NATION'S LARGEST AND MOST MODERN PRODUCTION FOUNDRIES

ESTABLISHED 1866
THE WHELAND COMPANY
FOUNDRY DIVISION
MAIN OFFICE AND MANUFACTURING PLANTS
CHATTANOOGA 2, TENNESSEE

A Hammer Blow Secures Letters To Pattern

THE H. P. MAUGHLIN CO.
953 Ingleside Ave., Columbus, Ohio
Manufacturers of letters and numbers exclusively for over 30 years



Heroult

ELECTRIC MELTING FURNACE

. . . as ever, the dependable furnace for the production of high-grade stainless, alloy and rimming steels.

Precision-built, gear-driven mechanisms for maximum safety and dependability.

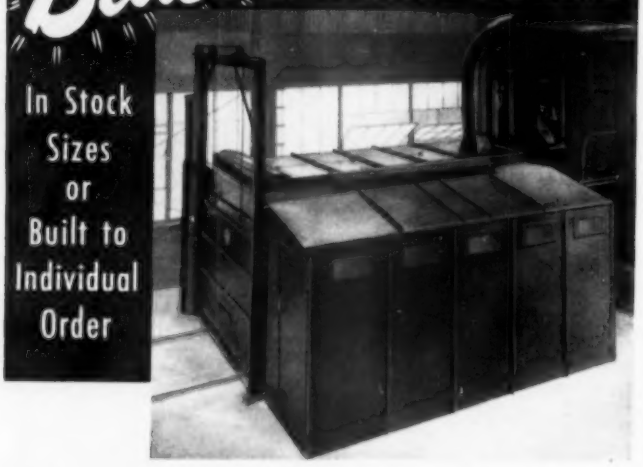
AMERICAN BRIDGE COMPANY
General Offices: Frick Building, Pittsburgh, Pa.

Contracting Offices in New York, Philadelphia, Chicago, San Francisco and other principal cities
United States Steel Export Company, New York

USS **AMERICAN BRIDGE**

UNITED STATES STEEL

Time Saving...Money Saving
MACLEOD
***Blast* CLEANING ROOMS**



Whatever your requirements may be for cleaning large or small metal parts, MACLEOD blast-cleaning rooms can do the work quickly and efficiently at low cost. MACLEOD rooms are offered in a number of stock sizes, but can be built to your specifications, if so desired.

For prices and descriptive literature write Dept. F

The MACLEOD Company
2234 BOGEN ST. CINCINNATI 22, OHIO ESTABLISHED 1897

★ ***Investigate the moderate-priced***
"RAPID" JOLT SQUEEZER

***Pioneer has satisfied hundreds of cost-conscious foundrymen with moderate-priced, efficient portable jolt and hand squeezers. Write for Bulletin "F".**

PIONEER MFG. CO.
Molding Machine Manufacturers for Over 20 years
MILWAUKEE (WEST ALLIS) WISCONSIN

the New **BLAW-KNOX "SHARK TOOTH" BUCKET**

Handles coke with minimum degradation and sand without leakage

THE new Blaw-Knox Single-Line Hook-On Type Bucket equipped with "Shark Teeth" rehandles coke with minimum degradation. By simply applying the liner plates inside the "shark teeth" the *same* bucket handles granular fines (sand, coal or small limestone) without leakage. Available for different headroom conditions. Write for Form 2265

BLAW-KNOX DIVISION
of Blaw-Knox Company
Farmers Bank Building, Pittsburgh 22, Pa.

BLAW-KNOX FOUNDRY BUCKETS

For Surface Blemishes in
ALUMINUM CASTINGS

Have you used the Smooth-On Foundry Cement made especially to correct blow holes, porous and rough spots, dents and other unsightly but harmless surface defects in otherwise sound *aluminum* alloy castings?

Applied like the widely used Smooth-On *Iron* Foundry Cement, Smooth-On No. 8 *Aluminum* Cement fills in evenly, hardens quickly, matches perfectly. Stays in place, too, for it expands slightly as it sets.

Smooth-On No. 8 Aluminum Cement comes in 1-and 5-lb. sizes. 1 lb. will fill 17 cu. in. Order it by NAME AND NUMBER from your supply house. If they haven't it, write us. If you have not yet discovered Smooth-On No. 8, ask us for

FREE SAMPLE TO TEST

You'll receive also the famous 40-page SMOOTH-ON HANDBOOK filled with industrial uses for the various Smooth-On Cements. 170 illustrations. Write today.

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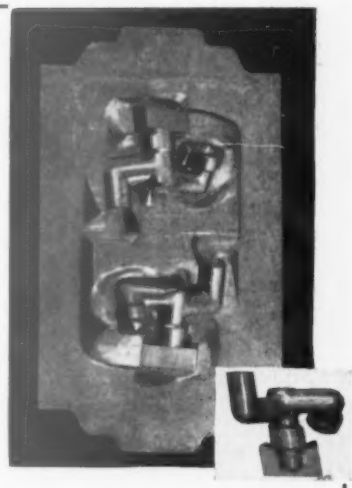

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ANGELL . . . PROVEN PRESSURE PROOF CHAPLETS

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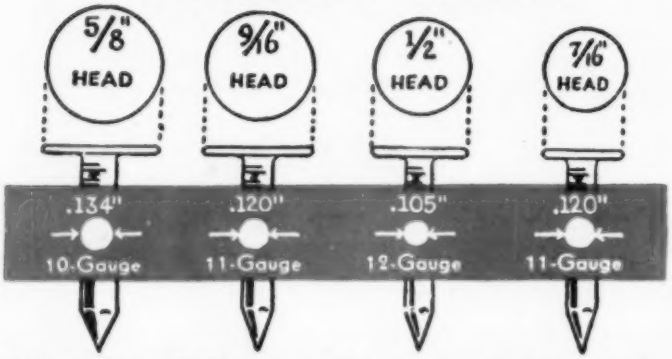

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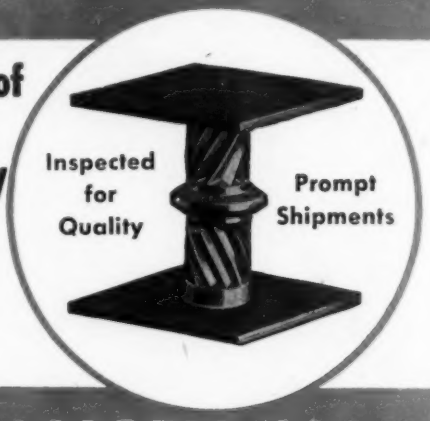

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Model AS

Model J

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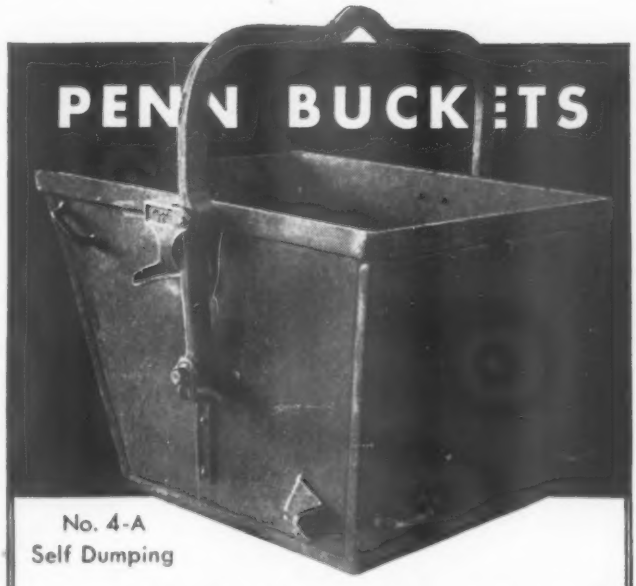

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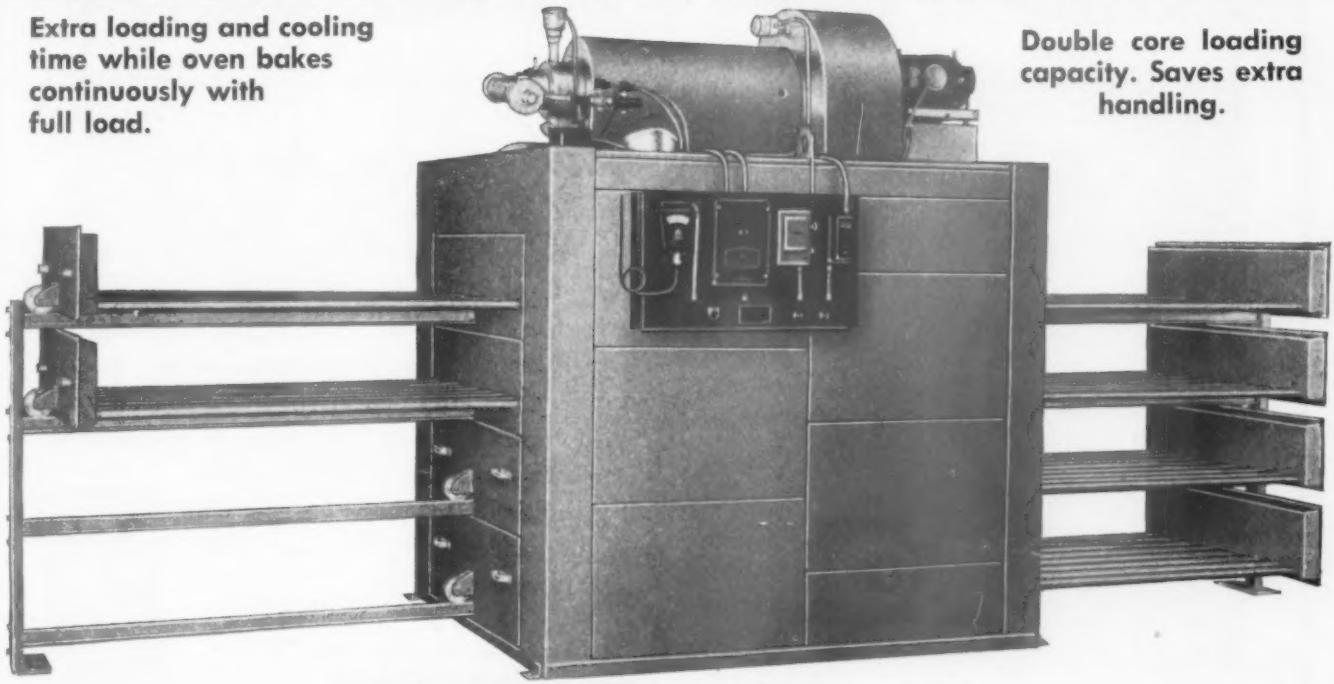
Extra loading and cooling time while oven bakes continuously with full load.

Double core loading capacity. Saves extra handling.



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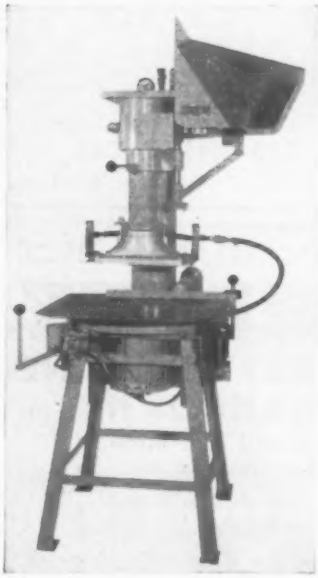

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Cores up to 8 lbs.

With the operation of one lever on the hand machine, or pushing of one button on the electric cycle, this machine will —Close the Core Box—Blow the Cores—Vibrate the Box—Draw the Cores—and Eject the Core Box to position where the dryer is applied. Produces more cores with less operator fatigue, and more cores per hour.

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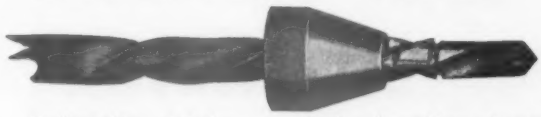

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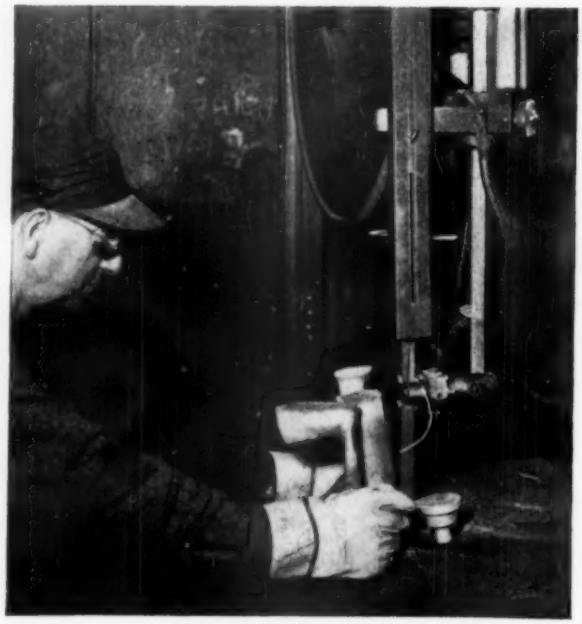

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You will profit by using the tougher Atlantic blades for clean, speedy cutting of gates and risers from castings. You can eliminate unnecessary grinding operations—our specially milled tooth construction makes it easier to cut closer to the body of the casting. All Atlantic Metal Cutting Band Saws are guaranteed as to material, workmanship and temper.

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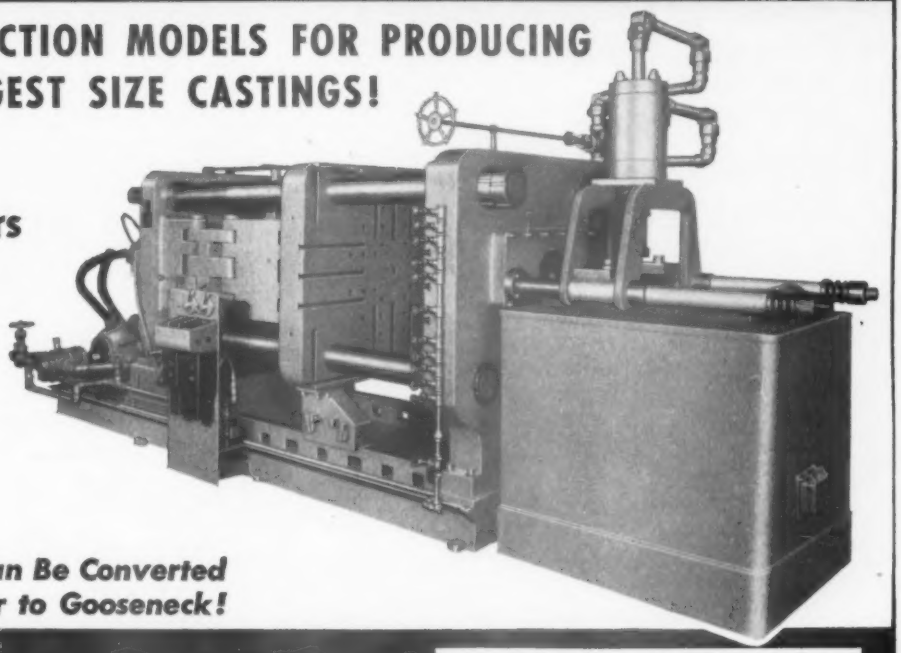

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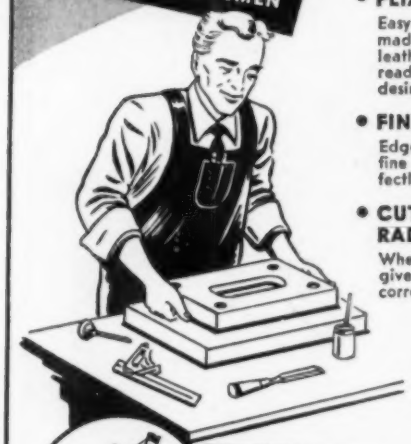

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Portable venturi high pressure oil burners with adjustable burner stand for heating and drying ladles.

Featuring
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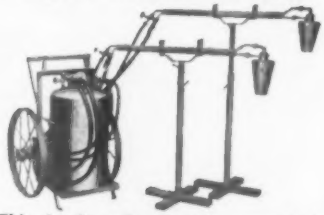

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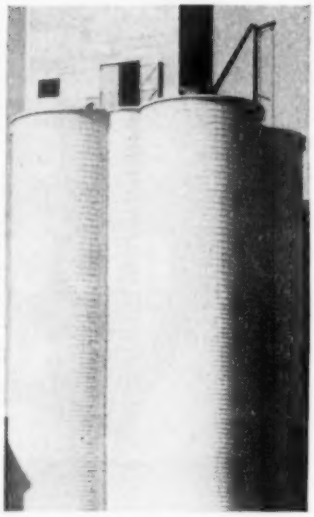

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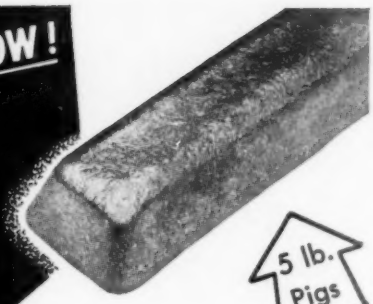

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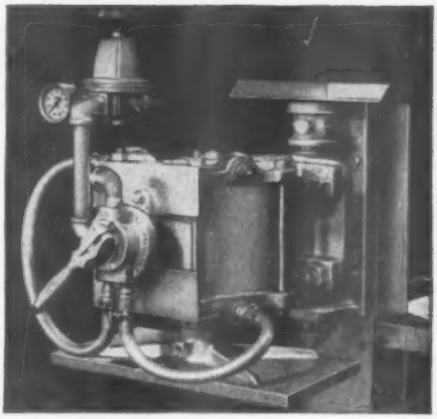

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Dollinger Corp., 36 Centre Park, Rochester 4, N. Y.

FILTERS (Liquid)

Dollinger Corp., 36 Centre Park, Rochester 4, N. Y.

FIRE BRICK

Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.

FIRE BRICK (Cont'd.)

Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Building, Buffalo 2, N. Y.
A. P. Green Fire Brick Co., Mexico, Missouri.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., Joliet, Ill.
Mexico Refractories Co., Mexico, Mo.
Norton Co., Worcester 6, Mass.
Stevens Inc., Frederic B., Detroit 16, Mich.
Chas. Taylor Sons Co., P.O. Box 58, Annex Sta., Cincinnati 14, Ohio.

FIRE CLAY

Eastern Clay Products, Inc., Jackson, O.
A. P. Green Fire Brick Co., Mexico, Missouri.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Illinois Clay Products Co., Joliet, Ill.
Ironton Fire Brick Co., Ironton, O.
Chas. Taylor Sons Co., P.O. Box 58, Annex Sta., Cincinnati 14, O.

FIRE SAND

Carborundum Co., Niagara Falls, N. Y.
Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

FIRESTONE

Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.

FLASK BANDS

Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.

FLASK BUSHINGS

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Universal Engineering Co., Frankenmuth, Mich.

FLASK PINS

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Universal Engineering Co., Frankenmuth, Mich.

FLASKS (Aluminum)

Adams Co., Dubuque, Iowa.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASKS (Dowmetal)

Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.

FLASK FILLERS

Bartlett & Snow, C., C., Co., 6201 Harvard Ave., Cleveland 5, O.

FLASK FILLERS (Cont'd.)

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Jeffrey Mfg. Co., Columbus 16, O.

FLASKS (Slip)

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, O.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

FLASKS (Snap)

Adams Co., Dubuque, Iowa.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Stevens, Inc., Frederic B., Detroit 16, Mich.

FLASKS (Steel)

Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

FLASK FITTINGS

Adams Co., Dubuque, Iowa.
Black, Sivalls & Bryson, Inc., 7500 E. 12th St., Kansas City 6, Mo.
Diamond Clamp & Flask Co., Richmond, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N. E., Canton 5, Ohio.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.

FLASK LIFT MACHINES

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

FLASK LUMBER

Dougherty Lumber Co., 4300 E. 66th St., Cleveland 5, O.
Rietz Lumber Co., 1800 N. Central Park Ave., Chicago, Ill.

FLASKS (Wood)

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 16th St., Chicago 9, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.

FLOORING (Non-Slip)

Norton Co., Worcester 6, Mass.

FLUXES

American-British Chemical Supplies Inc., 180 Madison Ave., New York 16, N. Y.
Apex Smelting Co., 2537 West Taylor St., Chicago 12, Ill.
Atlantic Chemical & Metals Co., 1925 N. Kenmore, Chicago 14, Ill.
Cleveland Flux Co., 1026 Main St., Cleveland 13, O.
Mathieson Chemical Corp., Mathieson Bldg., Baltimore 3, Md.

FLUXES (Cont'd.)

Niagara Falls Smelting & Refining Div., Continental-United Industries Co., Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.
Pittsburgh Metals Purifying Co., 1352 Marvista St., Pittsburgh 12, Pa.
Puro-Seal Co., 2323 West Third, Cleveland 13, Ohio.

FLUXES (Soldering, Welding & Tinning)

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

FOUNDRY CONSULTANTS

Lester B. Knight & Associates Inc., 600 West Jackson Blvd., Chicago 3, Ill.

FOUNDRY ENGINEERS

Edwin S. Carman, 1643 Lee Road, Cleveland 18, Ohio.
Lester B. Knight & Associates Inc., 600 West Jackson Blvd., Chicago 3, Ill.
A. A. Wickland Co., 205 W. Wacker Dr., Chicago 6, Ill.

FOUNDRY LAYOUT & METHODS

H. K. Ferguson, 1783 E. 11th St., Cleveland 14, Ohio.
Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.
Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

FOUNDRY NAILS

Capewell Mfg. Co., Hartford, Conn.
Crescent Brass & Pin Co., 5766 Trumbull Ave., Detroit, Mich.
Standard Horse Nail Corp., New Brighton, Pa.

FOUNDRY SHOVELS

(See SHOVELS)

FOUNDRY SUPPLY HOUSES

Combined Supply & Equipment Co., Inc., 215 Chandler St., Buffalo 7, N. Y.
Eastern Clay Products, Inc., Jackson, O.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Stevens, Inc., Frederic B., Detroit 16, Mich.

FURNACES (Aluminum & Magnesium Billets)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

FURNACES (Aluminum & Magnesium Forgings)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

FURNACES (Aluminum Melting)

Ajax Engineering Corp., Trenton, N. J.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.

FURNACES (Aluminum Rivet Heating)

Ajax Electric Co., Inc., Philadelphia 23, Pa.

FURNACES (Annealing)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

FURNACES (Crucible Melting)

Ajax Electrothermic Corp., Trenton, N. J.
Ajax Metal Co., Philadelphia 23, Pa.
Campbell-Hausfeld Co., 300-320 Moore St., Harrison, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

FURNACES (Electric Melting)

Ajax Electric Furnace Corp., 46 Richmond St., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
Ajax Metal Co., Philadelphia 23, Pa.
American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Greene Electric Furnace Co., 2702 6th So., Seattle 4, Wash.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Gas or Oil Fired)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Campbell-Hausfeld Co., Harrison, O.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Company, 750 Prospect Ave., Cleveland 15, Ohio.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

FURNACES (Gray Iron Melting)

American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.

FURNACES (Heat Treating)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.

FURNACES, HEAT TREATING (Electric)

Ajax Electric Co., Inc., Philadelphia 23, Pa.
Ajax Electrothermic Corp., Trenton, N. J.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

FURNACES (Induction Heating)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

FURNACES (Malleable Annealing)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
General Electric Co., Schenectady, N. Y.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Malleable Melting)

American Bridge Co., Pittsburgh 19, Pa.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.
Whiting Corporation, 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Nonferrous Melting)

Ajax Electrothermic Corp., Trenton, N. J.
Ajax Engineering Corp., Trenton, N. J.
Ajax Metal Co., Philadelphia 23, Pa.
Campbell-Hausfeld Co., Harrison, O.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

FURNACES (Powdered Coal)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

FURNACES (Steel Melting)

Ajax Electrothermic Corp., Trenton, N. J.
American Bridge Co., Pittsburgh 19, Pa.
Detroit Electric Furnace Div. of Kuhlman Electric Co., Bay City, Mich.
Pittsburgh Lectromelt Furnace Corp., P.O. Box 1125, Pittsburgh, Pa.

FURNACE BLOWERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Campbell-Hausfeld Co., Harrison, O.
Eclipse Fuel Engineering Co., 711 So. Main St., Rockford, Ill.
Joy Mfg. Co., La-Del Division, New Philadelphia, Ohio.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.

FURNACE LININGS

Campbell-Hausfeld Co., Harrison, O.
Carborundum Co., Perth Amboy, N. J.
Electro Refractories & Alloys Corp., Vars Building, Buffalo 2, N. Y.
A. P. Green Fire Brick Co., Mexico, Missouri.
Ironton Fire Brick Co., Ironton, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.
United States Graphite Co., Saginaw, Mich.

GAGGERS

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Wadsworth Equipment Co., 560 Lafollette St., Akron, Ohio.

GAS (Oxygen, Acetylene, Industrial)

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

GAS BURNERS

Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard St., Chicago 12, Ill.

GENERATORS (Acetylene)

Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

GLOVES (Industrial, Safety)

American Optical Co., Southbridge, Mass.
United States Rubber Co., 4300 New Haven Ave., Ft. Wayne 4, Ind.

GOGGLES and EYE PROTECTORS

American Optical Co., Southbridge, Mass.
Chicago Eye Shield Co., 2300 West Warren, Chicago 12, Ill.
B. F. McDonald Co., 5112 South Hoover St., Los Angeles 37, Calif.
Wilson Products Inc., Reading, Pa.

GRAPHITE

Asbury Graphite Mills, Asbury, N.J.
Acheson Colloids Corp., Port Huron, Mich.
Bloomsbury Graphite Co., Bloomsbury, N. J.
Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
International Graphite & Electrode Corp., St. Marys, Pa.
National Carbon Co. Inc., Carbon Products Div., 30 E. 42nd St., New York 17.
United States Graphite Co., Saginaw, Mich.

GRAPHITIZER

United States Graphite Co., Saginaw, Mich.

GRINDERS (Electric Portable)

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Independent Pneumatic Tool Co., Aurora, Ill.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
U. S. Electrical Tool Co., Cincinnati 4, O.

GRINDERS (Hand)

Chicago Wheel & Mfg. Co., 1101 W. Monroe, Chicago 7, Ill.

GRINDERS (Pneumatic Portable)

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Tex.
Independent Pneumatic Tool Co., Aurora, Ill.

GRINDERS (Pneumatic Portable) (Cont'd.)

Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.

GRINDERS (Surface, Bench, Disc, Floor)

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Independent Pneumatic Tool Co., Aurora, Ill.
U. S. Electrical Tool Co., 2488 River Rd., Cincinnati 4, O.
Vonnegut Moulder Corp., 1815 Madison Ave., Indianapolis 2, Ind.

GRINDERS (Swing Frame)

Fox Grinders, Inc., Oliver Bldg., Pittsburgh 22, Pa.
Sutter Products Co., Dearborn, Mich.
Vonnegut Moulder Corp., 1815 Madison Ave., Indianapolis 2, Ind.

GRINDING WHEELS—See ABRASIVE WHEELS

GRINDING WHEEL DRESSERS

Carborundum Co., Niagara Falls, N. Y.
Desmond-Stephans Mfg. Co., Urbana, O.

GRINDSTONES

Bay State Abrasive Products Co., Westboro, Mass.

GRIT (Abrasive)

Alloy Metal Abrasive Co., Ann Arbor, Mich.
American Steel Abrasives Co., Galion, O.
American Wheelabrator & Equipment Co., Mishawaka, Ind.
Carborundum Co., Niagara Falls, N. Y.
Clayton Sherman Abrasives Co., 3896 Lonyo Rd., Detroit 10, Mich.
Cleveland Metal Abrasive Co., 887 E. 67th St., Cleveland, Ohio.
Globe Steel Abrasive Co., Mansfield, Ohio.
Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Metal Blast, Inc., 871 E. 67th St., Cleveland, Ohio.
Pangborn Corp., Hagerstown, Md.
Pittsburgh Crushed Steel Co., Pittsburgh 1, Pa.

HAMMERS (Chipping)

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Dayton Pneumatic Tool Co., Dayton 1, Ohio.
Independent Pneumatic Tool Co., Aurora, Ill.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Schramm Inc., West Chester, Pa.

HARDNESS TESTING EQUIPMENT

Detroit Testing Machine Co., 19390 Grinnell Ave., Detroit 13, Mich.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
Steel City Testing Machines Inc., 8843 Livernois Ave., Detroit 4, Mich.
Foxboro Company, Foxboro, Mass.
Claude S. Gordon Co., 3000 So. Wallace, Chicago 16, Ill.
Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.

HEAT CONTROL AND RECORDING DEVICES (Cont'd.)

Lindberg Engineering Co., , Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.

HEATERS (Gas, Oil, Electric)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.
Ross Engineering Corp., J. O., 444 Madison Ave., New York 17, N.Y.

HEATERS (High Frequency Electric)

Ajax Electrothermic Corp., Trenton, N. J.

HEATERS (Indirect Fired)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

HEATERS (Space, Unit, Direct Fired)

Dravo Corp., Neville Island, Pittsburgh 25, Pa.
Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.

HEATERS (Space, Unit, Oven, Water)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Newcomb-Detroit Co. Inc., 5741 Russell St., Detroit 11, Mich.

HELMETS (Blasting)

American Wheelabrator & Equipment Co., Mishawaka, Ind.
American Optical Co., Southbridge, Mass.
B. F. McDonald Co., 5112 South Hoover St., Los Angeles 37, Calif.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

HELMETS (Welding)

American Optical Co., Southbridge, Mass.

HOISTS (Air)

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Curtis Pneumatic Machinery Div. Curtis Mfg. Co., 1943 Kienlen Ave., St. Louis 20, Mo.
Gardner-Denver Co., Quincy, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.

HOISTS (Chain)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.

HOISTS (Electric)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Harnischfeger Corp., 4411 W. National Ave., Milwaukee 14, Wis.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Modern Equipment Co., Port Washington, Wis.
Shepard-Niles Crane & Hoist Corp., Montour Falls, N. Y.

HOISTS (Electric) (Cont'd.)

Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

HOISTS (Hand)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.

HOISTS (Hydraulic)

Miller Motor Co., 4027 N. Kedzie, Chicago 18, Ill.

HOODS (Shakeout, pouring)

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

HOPPERS (Sand)

Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

HOSE (Air, Blasting, Water, Gas)

Boston Woven Hose & Rubber Co., 29 Hampshire, Cambridge 39, Mass.
Gardner-Denver Co., Quincy, Ill.
Hewitt Rubber Div. Hewitt-Robins Div., Inc., 240 Kinsington Ave., Buffalo 5, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Pangborn Corp., Hagerstown, Md.
Raybestos-Manhattan, Inc., Manhattan Rubber Div., Passaic, N. J.
Schramm Inc., West Chester, Pa.

HOSE FITTINGS

Boston Woven Hose & Rubber Co., 29 Hampshire, Cambridge 39, Mass.

HYDRAULIC CLEANING EQUIPMENT

Hydro-Blast Corp., 2050 N. Western Ave., Chicago 47, Ill.
Pangborn Corp., Hagerstown, Md.

HYDRO FINISHING EQUIPMENT

Pangborn Corp., Hagerstown, Md.

ILLUMINATORS (X-Ray Films)

Eastman Kodak Co., Rochester, N. Y.

IMPREGNATING SYSTEMS

Empire Varnish Co., 2636 E. 76th St., Cleveland 4, O.
Tincher Products Co., Sycamore 12, Ill.

INDUSTRIAL ENGINEERING SERVICE

Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

INGOT MOLDS

Acme Foundry Co., Detroit 16, Mich.

INGOTS (Nonferrous)

Ajax Metal Co., Philadelphia 23, Pa.
Federated Metals Div. of American Smelting and Refining Co., 120 Broadway, New York 5.
Apex Smelting Co., 2537 West Taylor St., Chicago 12, Ill.
Federated Metals Div., American Smelting and Ref. Co., New York 5.
Frontier Bronze Corp., 818 Elmwood Ave., Niagara Falls, N. Y.
International Nickel Co., Inc., 67 Wall St., New York City 5.
R. Lavin & Sons Inc., 3426 So. Kedzie Ave., Chicago 23, Ill.
Northwestern Iron & Metal Co., 900 "T" Street, Lincoln, Nebraska.
Sonken-Galamba Corp., Kansas City 18, Kansas.
Western Metals Co., 3201 So. Kedzie Ave., Chicago 23, Ill.

INJECTION MOLDING MACHINES

Lester-Phoenix Inc., 2711 Church St., Cleveland 13, Ohio.

INOCULANTS

Carborundum Co., Perth Amboy, N. J.
United States Graphite Co., Saginaw, Mich.

IRON CEMENT

Smooth-On Mfg. Co., 570 Communipaw Ave., Jersey City 4, N. J.

IRON ORE

Pickands, Mather & Co., Cleveland 14, O.

IRON OXIDES

Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Delta Oil Products Co., Milwaukee 9, Wis.
Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

JACKETS (Mold)

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.
Diamond Clamp & Flask Co., Richmond, Ind.
Fremont Flask Co., Fremont, O.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.

LABORATORY EQUIPMENT (Chemical)

Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.

LABORATORY EQUIPMENT (Physical)

Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
E. Leitz Inc., 730 Fifth Ave., New York 19, N. Y.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Norton Co., Worcester 6, Mass.

LADLES

Industrial Equipment Co., Minster, O.
Industrial Fabricating, Inc., 817 Hall St., Eaton Rapids, Mich.
Modern Equipment Co., Port Washington, Wis.
Frederic B. Stevens, Inc., Detroit 16, Mich.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

LADLE LININGS

A. P. Green Fire Brick Co., Mexico, Missouri.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Ironton Fire Brick Co., Ironton, Ohio.
United States Graphite Co., Saginaw, Mich.

LEAD

Federated Metals Div., American Smelting and Refining Co., 120 Broadway, New York 5.

LINSEED OIL

Hercules Powder Co., Wilmington 99, Del.

LOADERS

Clearfield Machine Co., Clearfield, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

LOADERS (Tractor-Mounted)

Frank G. Hough Co., Libertyville, Ill.

LUBRICANTS (Industrial)

Acheson Colloids Corp., Port Huron, Mich.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.
United States Graphite Co., Saginaw, Mich.

MACHINE KEYS

Standard Horse Nail Corp., New Brighton, Pa.

MAGNESIUM (Ingots)

Apex Smelting Co., 2537 West Taylor St., Chicago 12, Ill.
Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

MAGNET CONTROLLERS

Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.

MAGNETS

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

MANGANESE (Briquets)

Electro Metallurgical Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

MATCH PLATE METAL

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.

MATCHPLATES

Accurate Match Plate Co., 1847 W. Carroll St., Chicago, Ill.
Central Pattern Co., Quincy, Ill.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Industrial Pattern Works, 2625 West Belmont Ave., Chicago 18, Ill.
Plaster Process Castings Co., 6922 Carnegie Ave., Cleveland 3, O.
Scientific Cast Products Corp., 1388-92 E. 40th St., Cleveland 3, O.
Springfield Pattern Works Inc., 124 Switzer Ave., Springfield, Mass.
Arthur E. Will, 643 West 11th St., Erie, Pa.

MATERIALS HANDLING EQUIPT.

Frank G. Hough Co., Libertyville, Ill.

MATERIALS HANDLING (Hoists)

Chisholm-Moore Hoist Corp. and Columbus-McKinnon Chain Corp., Tonawanda, N. Y.

MECHANICAL ENGINEERS

Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.

MELTING POTS

Acme Foundry Co., Detroit 16, Mich.

METAL CLEANING EQUIPMENT

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

METALLOGRAPHIC EQUIPMENT

Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

METALLURGISTS

Crobaugh Co., Frank L., 1426 West Third St., Cleveland 13, Ohio.

METERS (Gas, Air, Water)

Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.
Roots-Connersville Blower Corp., Connersville, Ind.

MIXERS (Core Wash)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Multiplex Machinery Corp., Elmore, Ohio.

MIXERS (Sand and Clay)

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Clearfield Machine Co., Clearfield, Pa.
Construction Machinery Co., Waterloo, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, Ohio.
Jeffrey Mfg. Co., 907 N. Fourth St., Columbus 16, O.
Multiplex Machinery Corp., Elmore, Ohio.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Posey Iron Works, Inc., Lancaster, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

MOLD CONVEYORS

Bartlett & Snow, C. O., Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Logan Co., 580 Cabel, Louisville, Ky.
Mathews Conveyer Co., Ellwood City, Pa.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.

MOLD COOLING HOODS

Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

MOLD DRYERS

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

MOLD OVENS and DRYERS

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.

MOLD OVENS and DRYERS (Cont'd.)

Despatch Oven Co., Minneapolis 14, Minn.
Drying Systems, Inc., 1801 Foster Ave., Chicago 40, Ill.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, O.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.
Ross Engineering Corp., J. O., 444 Madison Ave., New York 17, N. Y.

MOLD TRUCKS (Power Operated)

Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.

MOLD WASH

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
National Carbon Co., Inc., Carbon Products Div., 30 E. 42nd St., New York 17, N. Y.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.
United States Graphite Co., Saginaw, Mich.

MOLDING MACHINES

Adams Co., Dubuque, Iowa.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Berkshire Mfg. Co., 1111 Power Ave., Cleveland 14, Ohio.
British Moulding Machine Co., Faverham, Kent, England.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Johnston & Jennings Div., Pettibone-Mulliken Corp., 2424 No. Cicero Ave., Chicago 39, Ill.
Milwaukee Foundry Equipment Div. Spo Inc., 3238 W. Pierce St., Milwaukee 4, Wis.
Moline Iron Works, Moline, Ill.
Nichols, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Pioneer Mfg. Co., West Allis, Wis.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Jolt)

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1553 West Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Johnston & Jennings Div., Pettibone-Mulliken Corp., 2424 No. Cicero Ave., Chicago 39, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Rollover)

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.

MOLDING MACHINES (Rollover) (Cont'd.)

Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Johnston & Jennings Div., Pettibone-Mulliken Corp., 2424 No. Cicero Ave., Chicago 39, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Sutter Products Co., Dearborn, Mich.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING MACHINES (Squeeze)

Adams Co., Dubuque, Iowa.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Davenport Machine & Foundry Co., Davenport, Iowa.
Herman Pneumatic Machine Co., Union Bank Bldg., Pittsburgh 22, Pa.
International Molding Machine Co., LaGrange Park, Ill.
Johnston & Jennings Div., Pettibone-Mulliken Corp., 2424 No. Cicero Ave., Chicago 39, Ill.
Milwaukee Foundry Equipment Div., Spo Inc., 3328 Pierce St., Milwaukee 4, Wis.
Moline Iron Works, Moline, Ill.
Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

MOLDING SANDS

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Ottawa Silica Co., Ottawa, Ill.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

MOLYBDENUM

Molybdenum Corporation of America, Pittsburgh 19, Pa.

MONOGRAMS & TRADE MARKS

H. P. Maughlin Co., 953 Ingleside Ave., Columbus, Ohio.

MONORAIL SYSTEMS

American Monorail Co., 13104 Athens Ave., Cleveland 7, O.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., 1155 East 283rd St., Wickliffe, O.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Modern Equipment Co., Port Washington, Wis.

MOTORS (Electric)

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Ohio Electric Mfg. Co., 5906 Maurice Ave., Cleveland, Ohio.

MULLERS (Portable)

Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio.

NAILS (Chill)

Angell Nail & Chaplet Co., 4580 E. 71st St., Cleveland 5, O.
Crescent Brass & Pin Co., 5766 Trumbull Ave., Detroit, Mich.
Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.
Standard Horse Nail Corp., New Brighton, Pa.

NICKEL

International Nickel Co., Inc., 67 Wall St., New York City 5.

NITROGEN

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

NOZZLES (Blasting)

Alloy Metal Abrasives Co., 311 W. Huron St., Ann Arbor, Mich.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Davenport Machine & Foundry Co., Davenport, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Norton Co., Worcester 6, Mass.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

OIL BURNERS

Hauck Manufacturing Co., 106 Tenth St., Brooklyn 15, N. Y.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Stroman Furnace & Engineering Co., Div. of Peterson Oven Co., 9900 Franklin Ave., Franklin Park, Ill.

OVENS (Annealing and Heat Treating)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Electric Furnace Co., Salem, Ohio.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Company, 750 Prospect Ave., Cleveland 15, O.
Lindberg Engineering Co., Fisher Furnaces Div., 2450 West Hubbard, Chicago 12, Ill.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

OVENS (Core) (See CORE OVENS)

OVENS (Enameling, Japanning)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

OVENS (Mold)

Carl-Mayer Corp., 3030 Euclid Ave., Cleveland 15, Ohio.
Despatch Oven Co., Minneapolis 14, Minn.
Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.
Lanly Co., 750 Prospect Ave., Cleveland 15, Ohio.

OXYGEN

Air Reduction Sales Co., 60 East 42nd St., New York 17, N. Y.
Linde Air Products Co., 30 E. 42nd St., New York 17, N. Y.

PAINTS (Graphite)

Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.

PARTING COMPOUNDS

Delta Oil Products Co., Milwaukee 9, Wis.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
E. F. Houghton Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.
Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.

PARTING COMPOUNDS (Cont'd.)

Frederic B. Stevens, Inc., Detroit 16, Mich.
Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PATTERN COATINGS

American Lacquer Solvents Co., Phoenixville, Pa.

PATTERN COMPOUND

Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PATTERN LETTERS

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
H. P. Maughlin Co., 953 Ingleside Ave., Columbus, Ohio.

PATTERN LUMBER

Dougherty Lumber Co., Cleveland 5, O.
Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Rietz Lumber Co., 1800 N. Central Park Ave., Chicago, Ill.

PATTERN METAL

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.
Niagara Falls Smelting & Refining Div., Continental-United Industries Co. Inc., 2204 Elmwood Ave., Buffalo 17, New York.

PATTERN PLATES

Accurate Match Plate Co., 1847 W. Carroll St., Chicago, Ill.
Buffalo Pattern Works, 830 Hertel Ave., Buffalo, N. Y.
Central Pattern Co., Quincy, Ill.
City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.
Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Industrial Pattern Works, 2625 West Belmont Ave., Chicago 18, Ill.
Plaster Process Castings Co., 6922 Carnegie Ave., Cleveland 3.
Scientific Cast Products Corp., 1388-92 E. 40th St., Cleveland 3, O.
Arthur E. Will, 643 West 11th St., Erie, Pa.

PATTERN SHOP EQUIPMENT

Freeman Supply Co., 1152 East Broadway, Toledo, Ohio.
Milwaukee Leather Belting Co., 1114 No. Water St., Milwaukee, Wis.
Oliver Machinery Company, Grand Rapids 2, Mich.

PATTERNS

Industrial Pattern Works, 2625 West Belmont Ave., Chicago 18, Ill.

PATTERNS (Plastic)

Central Pattern Co., Quincy, Ill.

PATTERNS (Wood, Metal)

Accurate Match Plate Co., 1847 W. Carroll St., Chicago, Ill.
Buffalo Pattern Works, 830 Hertel Ave., Buffalo, N. Y.
Central Pattern Co., Quincy, Ill.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.

PATTERNS (Wood, Metal) (Cont'd.)

City Pattern Foundry & Machine Co., 1161 Harper Ave., Detroit 11, Mich.
Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Industrial Pattern Works, 2625 West Belmont Ave., Chicago 18, Ill.
S. P. O. Incorporated, 7500 Grand Division Ave., Cleveland 5, O.
Springfield Pattern Works Inc., 124 Switzer Ave., Springfield, Mass.
Wellman Bronze & Aluminum Co., 2525 E. 93rd St., Cleveland 4, O.
Arthur E. Will, 643 West 11th St., Erie, Pa.

PERMANENT MOLDS

Centrifugal Casting Machine Co., Tulsa, Okla.
Reserve Machine & Tool Co., 10026 Detroit Ave., Cleveland, Ohio.

PHOSPHOR COPPER

Federated Metals Division of American Smelting and Refining Co., 120 Broadway, New York 5, N. Y.
Niagara Falls Smelting & Refining Div. Continental-United Industries Co. Inc., 2204 Elmwood Ave., Buffalo 17, N. Y.

PHOTOGRAPHIC EQUIPMENT

Eastman Kodak Co., Rochester, N. Y.
General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

PHOTOGRAPHY (Industrial)

Eastman Kodak Co., Rochester, N. Y.

PIG IRON

Hickman-Williams & Co., Union Commerce Bldg., Cleveland 14, O.
Jackson Iron & Steel Co., Jackson, Ohio.
Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.
Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.
Pickands, Mather & Co., Cleveland 14, O.
Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.
Tennessee Products & Chemical Corp., American National Bank Bldg., Nashville 3, Tenn.
Woodward Iron Co., Woodward, Ala.

PIG IRON (Silvery)

Jackson Iron & Steel Co., Jackson, O.
Keokuk Electro Metals Co., 429 So. 4th St., Keokuk, Iowa.
Miller & Company, 332 S. Michigan Ave., Chicago 4, Ill.

PINS (Flask)

Hines Flask Co., 3431 W. 140th St., Cleveland 11, Ohio.
Shanafelt Mfg. Co., 3623 Winfield Way, N.E., Canton 5, Ohio.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.
Truscon Steel Co., Pressed Steel Div., 6100 Truscon Ave., Cleveland, Ohio.
Universal Engineering Co., Frankenmuth, Mich.

PISTON RINGS (for Molding Machines, Compressors, etc.)

Nicholls, Wm. H., Co., Richmond Hill, Long Island 18, N. Y.

PLANT ENGINEERING SERVICE

H. K. Ferguson, 1783 E. 11th St., Cleveland 14, Ohio.
Giffels & Vallet, Inc., Marquette Bldg., Detroit, Mich.
Lester B. Knight & Associates, Inc., 600 West Jackson Blvd., Chicago 3, Ill.

PLATES (Bottom)

Adams Co., Dubuque, Iowa.
Sterling Wheelbarrow Co., 7100 W. Walker St., Milwaukee 14, Wis.

PLATES (Core Drying)

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Johns-Manville, 22 East 40th St., New York 16.

PLATING TEMPERATURE CONTROLS

Foxboro Company, Foxboro, Mass.

PLUMBAGO

Bloomsbury Graphite Co., Bloomsbury, N. J.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Frederic B. Stevens, Inc., Detroit 16, Mich.
United States Graphite Co., Saginaw, Mich.

PNEUMATIC TOOLS

Chicago Pneumatic Tool Co., 6 East 44th St., New York 17, N. Y.
Cleco Pneumatic Tool Div., Reed Roller Bit Co., Houston, Texas.
Dayton Pneumatic Tool Co., Dayton 1, Ohio.
Gardner-Denver Co., Quincy, Ill.
Independent Pneumatic Tool Co., Aurora, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Joy Mfg. Co., Sullivan Division, Michigan City, Ind.
Master Pneumatic Tool Co., Inc., Orwell, Ohio.
Rotor Tool Co., 17325 Euclid Ave., Cleveland 12, Ohio.
Schramm Inc., West Chester, Pa.

POURING DEVICES

Industrial Equipment Co., Minster, Ohio.
Modern Equipment Co., Port Washington, Wis.
Whiting Corp., 15607 Lathrop Ave., Harvey, Ill.

PRESSER BOARDS

Adams Co., Dubuque, Iowa.
Chicago Mfg. & Distributing Co., 1928 W. 46th St., Chicago 9, Ill.

PRESSURE CASTING SEALER

Empire Varnish Co., 2636 E. 76th St., Cleveland 4, O.
Tincher Products Co., Sycamore 12, Ill.

PRESSURE RECORDERS

Foxboro Company, Foxboro, Mass.

PROTECTIVE MATERIALS (X-Ray)

General Electric X-Ray Corp., 4855 Electric Ave., Milwaukee 14, Wis.

PULLEYS (Magnetic)

Dings Magnetic Separator Co., 4740 Electric Ave., Milwaukee 7, Wis.
Stearns Magnetic Mfg. Co., 662 S. 28th St., Milwaukee 4, Wis.

PUMPS

Construction Machinery Co., Waterloo, Iowa.
Gardner-Denver Co., Quincy, Ill.
Claude B. Schneible Co., 2827 25th St., Detroit 16, Mich.

PUMPS (Dry, Vacuum)

Allis Chalmers Mfg. Co., Milwaukee 1, Wis.
Fuller Company, Catasauqua, Pa.
Roots-Connersville Blower Corp., Connersville, Ind.

PURIFIERS

Cleveland Flux Co., 1026 Main St., Cleveland 13, O.

PUSH-OFF MACHINES

Beardsley & Piper Co., 2424 N. Cicero, Chicago 39, Ill.
Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
International Molding Machine Co., LaGrange Park, Ill.
Milwaukee Foundry Equipment Div. Spo Inc., 3238 W. Pierce St., Milwaukee 4, Wis.

PUTTY (Foundry)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

PYROMETERS

Foxboro Company, Foxboro, Mass.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
Claude S. Gordon Co., 3000 So. Wallace, Chicago 16, Ill.
Illinois Testing Laboratories, Inc., 418 N. LaSalle St., Chicago 10, Ill.
Marshall Co., L. H., 270 W. Lane, Columbus 1, O.
Pyrometer Instrument Co., Bergenfield, N. J.
Tamms Industries Inc., 228 N. LaSalle St., Chicago 1, Ill.

PYROMETERS (Immersion)

Pyrometer Instrument Co., Bergenfield, N. J.

PYROMETERS (Optical)

Pyrometer Instrument Co., Bergenfield, N. J.

RACKS (Core Ovens)

Foundry Equipment Co., 1831 Columbus Rd., Cleveland 13, Ohio.

RADIOGRAPHY (Industrial)

Eastman Kodak Co., Rochester, N. Y.
Eldorado Mining & Refining Ltd., P.O. Box 379, Ottawa, Ont.
Radium Chemical Co., Inc., 570 Lexington Ave., New York 22, N. Y.

RADIUM

Eldorado Mining & Refining Ltd., P.O. Box 379, Ottawa, Ont.
Radium Chemical Co., Inc., 570 Lexington Ave., New York 22, N. Y.

REFRACTORIES

Babcock & Wilcox Co., 85 Liberty St., New York 6, N. Y.
Carborundum Co., Niagara Falls, N. Y.
Carborundum Co., Perth Amboy, N. J.
Cleveland Quarries Co., 1740 E. 12th St., Cleveland 14, O.
Joseph Dixon Crucible Co., Monmouth St., Jersey City, N. J.
Eastern Clay Products, Inc., Jackson, O.
Electro Refractories & Alloys Corp., Vars Bldg., Buffalo 2, N. Y.

REFRACTORIES (Cont'd.)

A. P. Green Fire Brick Co., Mexico, Missouri.
Harbison-Walker Refractories Co., 1745 Farmers Bank Bldg., Pittsburgh 22, Pa.
Ironton Fire Brick Co., Ironton, O.
Lindberg Engineering Co., Fisher Furnace Div., 2450 West Hubbard, Chicago 12, Ill.
Mexico Refractories Co., Mexico, Mo.
Norton Co., Worcester 6, Mass.
Richard C. Remmey Son Co., Hedley St. & Delaware River, Philadelphia 37, Pa.
Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.
Chas. Taylor Sons Co., P.O. Box 58, Annex Sta., Cincinnati 14, Ohio.
United States Graphite Co., Saginaw, Mich.

REPAIR PARTS (Molding Machine)

Pioneer Mfg. Co., West Allis, Wis.

RESPIRATORS

Wilson Products Inc., Reading, Pa.

RIDDLES

Frederic B. Stevens, Inc., 18th St. & Vernor Highway, Detroit 16, Mich.

RIDDLES (Electric)

Champion Foundry & Machine Co., 1553 W. Madison St., Chicago 7, Ill.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Foundry Supplies & Mfg. Co., 2221 Orchard St., Chicago 14, Ill.
Great Western Mfg. Co., Leavenworth, Kans.

RIDDLES (Hand)

Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

ROD DIP

Smith Oil & Refining Co., 1102 Kilburn Ave., Rockford, Ill.

ROD STRAIGHTENERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.

RODS (Steel)

Republic Steel Corp., 3100 E. 45th St., Cleveland 4, Ohio.

ROLLER-HEARTH FURNACES (Electric Annealing)

General Electric Co., Schenectady, N. Y.
Holcroft & Company, 6545 Epworth Blvd., Detroit 10, Mich.

RUBBER LINING MATERIAL (Abrasive Resisting)

Pangborn Corp., Hagerstown, Md.

SAFETY CLOTHING

American Optical Co., Southbridge, Mass.
B. F. McDonald Co., 5112 South Hoover St., Los Angeles 37, Calif.
Pangborn Corp., Hagerstown, Md.

SAND ARRESTER TUBES

Martin Engineering Co., Kewanee, Ill.

SAND (Core, Molding, Blasting)

American Silica Sand Co., Central Life Bldg., Ottawa, Ill.
Carpenter Brothers, Inc., 606 West Wisconsin, Milwaukee 3, Wis.
Ottawa Silica Co., Ottawa, Ill.
Pangborn Corp., Hagerstown, Md.
Producers Core Sand Corp., Michigan City, Ind.
Standard Silica Corp., 209 So. LaSalle St., Chicago 4, Ill.
Wedron Silica Co., 38 So. Dearborn St., Chicago, Ill.

SAND BLAST BARRELS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Pangborn Corp., Hagerstown, Md.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST CABINETS

American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

SAND BLAST EQUIPMENT

American Air Filter Co., 266 Central Ave., Louisville 8, Ky.
American Wheelabrator & Equipment Co., 505 S. Byrkit St., Mishawaka, Ind.
Hydro-Blast Corp., 2550 N. Western Ave., Chicago 47, Ill.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.
Tabor Mfg. Co., 6225 Tacony St., Philadelphia 35, Pa.

SAND BLAST NOZZLES

American Wheelabrater & Equipment Co., Mishawaka, Ind.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, O.
Norton Company, Worcester 6, Mass.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST ROOMS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Hydro-Blast Corp., 2550 No. Western Ave., Chicago 47, Ill.
Macleod Co., 2232 Bogen St., Cincinnati, Ohio.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST TABLES

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.
W. W. Sly Mfg. Co., 4753 Train Ave., Cleveland 2, Ohio.

SAND BLAST CONDITIONERS

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.

SAND CONTROL & TESTING EQUIPMENT

Beardsley & Piper Co., 2424 No. Cicero, Chicago 39, Ill.
Harry W. Dietert Co., 9330A Roselawn Ave., Detroit 4, Mich.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND CONVEYING and HANDLING EQUIPMENT

American Air Filter Co., Louisville 8, Ky.
Ajax Flexible Coupling Co., Westfield, N. Y.
C. O. Bartlett & Snow Co., 6201 Harvard Ave., Cleveland 5, O.
Beardsley & Piper Co., The, 2424 No. Cicero, Chicago 39, Ill.
Clark Industrial Truck Div., Clark Equipment Co., Battle Creek, Mich.
Clearfield Machine Co., Clearfield, Pa.
Cleveland Tramrail Div. of Cleveland Crane & Engineering Co., Wickliffe, Ohio.

SAND CONVEYING and HANDLING EQUIPMENT (Cont'd.)

Frank G. Hough Co., Libertyville, Ill.
Jeffrey Mfg. Co., 907-99 N. Fourth St., Columbus 16, O.
Joy Mfg. Co., Joy Division, Pittsburgh, Pa.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.
Newaygo Engineering Co., Newaygo, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, O.
Penn Iron Works, Reading, Pa.
Royer Foundry & Machine Co., Kingston, Pa.

SAND CONVEYING and HANDLING EQUIPMENT (Pneumatic)

Fuller Company, Catasauqua, Pa.
Robins Conveyors Div., Hewitt-Robins Inc., 270 Passaic Ave., Passaic, N. J.

SAND COOLING SYSTEMS

Newaygo Engineering Co., Newaygo, Mich.

SAND DRYERS

Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.
Bartlett & Snow Co., C. O., 6201 Harvard Ave., Cleveland 5, Ohio.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Nichols Engineering & Research Corp., 70 Pine St., New York 5, N. Y.

SANDERS (Pneumatic)

Cleco Division of Reed Roller Bit Co., Houston, Texas.

SANDING MACHINERY (Disc, Spindle, Belt, etc.)

Freeman Supply Co., 1152 E. Broadway, Toledo 5, Ohio.
Oliver Machinery Company, Grand Rapids 2, Mich.

SAND MEASURING and WEIGHING DEVICES

Baker Perkins Inc., Saginaw, Mich.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
National Engineering Co., 549 W. Washington St., Chicago 6, Ill.

SAND MIXERS

American Wheelabrator & Equipment Co., Mishawaka, Ind.
Baker Perkins Inc., Saginaw, Mich.
Beardsley & Piper Co., The, 2424 N. Cicero, Chicago 39, Ill.
Buckeye Products Co., 7022 Vine St., Cincinnati 16, Ohio.
Clearfield Machine Co., Clearfield, Pa.
Construction Machinery Corp., Waterloo, Iowa.
Federal Foundry Supply Co., 4600 E. 71st St., Cleveland 5, Ohio.
Link Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.
Multiplex Machinery Corp., Elmore, Ohio.
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1800	1 in.	Sturtevant	2	220/440	
1150	20 oz.	Nth.Amer.	10	220/440	3600
950	16 oz.	Nth.Amer.			
800	8 oz.	Sturtevant	7½	220/440	3600
800	24 oz.	American	10	220	3600
450	6 lbs.	A&B	30	220/440	3450
1800	1 in.	Sturtevant	2	220/440	
150	12 oz.	Nth.Amer.	1	220	3600

MOTOR REPAIR & MFG. CO.
1552 HAMILTON AVENUE
CLEVELAND, OHIO

SURPLUS SAND BLASTING EQUIPMENT

Pangborn EN 2 cabinet suction type $275.
Pangborn 6' rotary blast tables $800.
Pangborn 2AQ1 generator with BVR7 abrasive separator elevator $550.
Wheelabrator—tumblast 36" x 42"

M. ELSTEIN
141 MANGIN STREET
NEW YORK 2, N. Y.

FOR SALE

Hines Pop Off Flasks. Write for list. Address: Box 251, The FOUNDRY, Cleveland 13, Ohio.

FOR SALE

86" AMERICAN WHEELABRATOR SWING TABLE. Serial #64445. Installed 1948. **Heavy duty construction.** Averaged 4 hours daily two years to May 12 last. In perfect operating condition.

OSBORN #92 CORE BLOWING MACHINE #11408E. Installed 1946 with companion machine Osborn #147. Hand Ram, Hand Rollover, Draw Core Machine #11956A. Installed 1948. Used about 100 hours only.

TWO OSBORN #403W Jolt Rollover Pattern Draw #11905 and #11463. Installed 1948 and 1946. Used only intermittently. In excellent condition.

Miscellaneous other Osborn Jolt Rollover Pattern Draw Machines #403, #405, #405-77, #601, and #602.

Y&T 4000# high lift and 4" lift Platform Trucks, Brinell Machines, Steel Flasks, Transite Core Plates, etc.

THE MANUFACTURERS FOUNDRY COMPANY
TEL. 3-3109 WATERBURY, CONN.

FOR SALE

1—Stroman Economelt Reverberatory Furnace (Sklenar Type) 600# capacity—arranged for oil burning.

Write for appointment.

IMPERIAL BRASS MFG. CO.

1200 W. HARRISON ST. CHICAGO 7, ILL.

ATTEN: W. C. ALVIN

FOUNDRY EQUIPMENT FOR SALE

1—9' LF-14 Pangborn Rotoblast Table.
1—#28GK-2 Pangborn Rotoblast Barrel.
(The above two machines may be seen in operation until January 1st, 1951, when they will be available for shipment.)
2—Oxweld Type MP-5, 150# size, Acetylene Generators.
1—Johnston and Jennings No. 918-B, Jolt Rollover Pattern Draw, with Automatic Adjustable Rollout Conveyor.
1—Johnston & Jennings No. 683, Jolt Stripper Moulding Machine, 12" dia. Jolt Cylinder, 16" Draw.
1—Tabor Plain Jolt Molding Machine, 6" cylinder, 36" x 36" Steel Table, 1300# capacity.
1—Jeffrey Portable Sanditioner, Type "P", Form "B", Class 1.

CRUCIBLE STEEL CASTING COMPANY
LANSDOWNE, PENNA.
PHONE AL 4-5200

Classified Advertising

For Sale

FOR SALE

MOLDING MACHINES
1—International Type GR Stationary 24 x 10
1—International Type RJ Stationary 14 x 8
1—International Type G Stationary 24 x 10
1—International Type R Portable 24 x 10
1—International Type F Stationary 26 x 8
1—International Type M Portable 24 x 10
1—Osborn 74W Plain Squeeze Portable
2—Osborn 75W Plain Squeeze Portable
3—Osborn 75J Jolt Squeeze Portable
3—Federal RAPID Jolt Squeeze Portable
4—Arcade 72-28 Jolt Squeeze Stationary
2—Tabor Jolt Squeeze
2—SPO #305 Jolt Strippers
2—SPO #611B Stationary Oscillating Jolt Squeeze Strippers
1—SPO #4½ JHS Jolt Hand Strip

BLOWERS FOR CUPOLAS AND FURNACES
1—40 HP Spencer Turbine 5100 CFM 18-oz. pressure
Maxon-Premix Blowers for Gas ¼ to 1 HP

METAL MELTING EQUIPMENT
1—Stationary Crucible Aluminum Furnace, gas fired, 400# Cap. complete with blower and motor
1—Hausfeld 1450-M Tilting Crucible Furnace, Multiple Burner, 400# aluminum
1—Stroman 750# brass, Tilting Crucible Furnace
1—Stationary #80 Crucible Furnace
1—Hausfeld 2000# aluminum capacity furnace, barrel type, open flame, oil fired
1—New Modern Model E Pouring Ladle, 300# cap.
New 32" to 41" dia. shell cupolas made to order.

TUMBLING MILLS AND SAND BLAST
4—28 x 56" Round Exhaust Mills
1—Pangborn No. 2 GH direct pressure type sand blast barrel, motor driven. Complete unit
1—Pangborn Sand Blast Unit, including generator tank, shot cleaner, bucket elevator. Suitable for use with room

MISCELLANEOUS
1—Continuous Heat Treat Furnace 57' long, 1200° F. max.
1—Lamson Endless Mold Conveyor 100' long x 16' wide, with 19 x 26" pallets, 36" on centers
2—Type M Beardsley Piper Screenarators
2—Jeffrey Sanditioners
1—Standard Core Sand Mixer, with 3 HP motor
2—Sly Economy #12 Cloth Screen Dust Collectors
1—Demmler #1 Core Blower
1—9 x 8 Ingersoll Rand Air Compressor, with motor
1—Quincy 10 HP Air Compressor. Complete Unit.
4—Heavy Duty Flexible Shaft Grinders 2 HP
Complete stock of rebuilt mill and dust exhaust blowers

CLIFTON MACHINERY COMPANY
1023 W. SIXTH ST. CINCINNATI 3, OHIO

FOR SALE

Sand cutter 79/60, American model M, serial No. M 298. All electric—220 V. A-1 condition. Address: EMPIRE PATTERN and FOUNDRY CO., BOX 1647, TULSA, OKLAHOMA.

FOR SALE

All equipment necessary for a small foundry. Bought new. Will take late model car or house trailer in trade. Address: Box 262, The FOUNDRY, Cleveland 13, Ohio.

EQUIPMENT FOR SALE

1—American Wheelabrator No. 3 tablast
1—118 Parsons dust arrestor
1—7 Whiting cupola and 5½ Roots blower
1—charging device for two cupola including jib hoist slewing device, wishbones, cone bottom buckets, motors and controls.
1—Redford bench coreblower
1—American sandcutter model M 79-60
3—No. 2136 SPO jolt squeeze strip molding machines
8—No. 275 JW 7 Osborn jolt squeezers
1—complete equipment for bonderizing including tanks, racks and supplies

LEWIS MOORE JR.
2296 E. BROAD ST. COLUMBUS, OHIO

For Sale

FOR SALE

2—Osborn #601 Jolt Rollover Pattern Draw Machines. Excellent condition. Late Model.
1—36" x 42" American Wheelabrator Tumblast
1—Molders' Friend Sand Conditioner
2—Tabor Portable Jolt Squeezers
1—Sly Centriblast Table, 6 ft. diameter. Used 30 months.
Miscellaneous pattern shop woodworking tools, including band saw, shaper, table saw and sander.

BOX 239
THE FOUNDRY CLEVELAND 13, OHIO

EQUIPMENT FOR SALE

1 type NS, 10 lbs., 10 KW, Detroit Electric Furnace, serial #1098K. Used approximately 160 kilowatthours. Address: INVESTMENT CASTING CO., 319 CHESTNUT ST., NEWARK 5, N. J.

FOR SALE

14—275 JW Stationary Jolt Squeezers
1—#2 Simpson Mixer with motor
1—Strohman 150 Oil Fired Tilting with blower
1—80' Continuous core oven gas fired
2—1000# C. I. Pot oil fired Tilting Furnaces
2—350# Detroit Electric Tilting Furnaces with 153 KVA Transformer
1—Gleason-American 60" Sand Cutter
1—I.R. Centrifugal Blower 6000 C.F.M. Gas, Oil & Electric Core Ovens
4—Osborn 2047 Rollover, Jolt & draw
1—International YPD 43598 30" x 72" x 12" Shepherd Skidlift Trucks
Tanks all sizes
8—Walker-York Coke Fired Melting Furnaces
2—2500# Teapot worm geared Ladles
2—Sand Blast Barrels
2—Swing Frame Grinders—1-16", 1-22" wheels.

SIX ACRES OF EQUIPMENT—Send us your inquiries. WE ARE ALWAYS IN THE MARKET FOR GOOD USED FOUNDRY EQUIPMENT.

UNIVERSAL MACHINE & EQUIPMENT CO.
320 E. BROAD ST.
SHILLINGTON, READING, PA.

FOR SALE

Beardsley & Piper sandslinger $2,000. Address: DORNBACK FURNACE AND FOUNDRY CO., 724 EAST 103rd ST., CLEVELAND 8, OHIO.

FOR SALE

Spencer Blower, excellent condition, rated capacity 9000 c.f.m. at 24 oz. pressure, complete with Westinghouse type CS-Frame 663 C, 100 h.p., 1750 r.p.m., 440-volt motor and Cutler Hammer Auto transformer starter. Priced at $4500. Address: LUFKIN FOUNDRY & MACHINE CO., LUFKIN, TEXAS.

FOR SALE

Two new Stone & French 16" gas fired crucible furnaces including domes, less pots and burners. $300 each. Address: INDUSTRIAL ENGINE EXCHANGE, 732, NORTH MAIN ST., FT. WORTH, TEXAS.

FOR SALE

MOLDING MACHINES
4—International 20" x 8", Type G
1—Herman, 1500 series, air clamps

CORE BLOWERS
1—Osborn #193, air draw
1—Demmler #3-E, air draw
1—B. & P. Screenarator, 3 HP, A.C. Motor
1—#8 Whiting Cupola—never used
1—#6 Roots Blower and Motor
1 Pr. Square Tumblers, back to back, 48" x 48" x 30"

RAY P. SCULLY
SCULLY MACHINERY & EQUIPMENT CO. NOT INC.
767 MILWAUKEE AVE. CHICAGO 22, ILL.
PHONE: CANAL 6-0314

FOR SALE

16—13" & 14" combination jolt squeeze strip molding machines, completely overhauled.

SUTTER PRODUCTS COMPANY
2005 WESTWOOD AVENUE
DEARBORN, MICHIGAN

For Sale

FOUNDRY EQUIPMENT

CORE MACHINES
1 "Tabor" pedestal type rollover
3 "Grimes" model C-216 rollover, 20 x 42 flask, 18" deep, 16" draw, hand operated
3 "Grimes" model C-414 rollover, 36 x 46 flask, 16" deep, 15" draw, hand operated

FURNACES & OVENS
9 "Hausfeld" 100# cap., pot type melting—oil fired
20 "Hausfeld" 200# cap., pot type melting—oil fired
4 "Hausfeld" 400# cap., pot type melting—oil fired
3 "Hausfeld" 1000# cap., tilting type melting—oil fired
6 "Hausfeld" 1200# cap., tilting type melting—oil fired
1 "Genrich" preheating oven, gas fired, recirculating
1 "Dispatch" core oven, small—approx. 6'w x 7' h x 7' deep—tag 202

SAND MIXERS
2 "Simpson" #1½ sand mixers

MISCELLANEOUS
2 "Tannewitz", mod. R1E, 42" band saw
1 Grinder, snagging, "U.S." double end, 30" wheel with 5 HP motor, tag #X158
1 "Kane & Roach" #5 DX wire straightener—¼" cap.
1 Shakeout, "Simplicity", mod. "B", 4' x 6' with 5 hp motor
6 Cranes, overhead traveling, bridge type, approx. 38' span 1 & 2 ton
1 "Delta" wood turning lathe, 12 x 36, ½ hp motor, 220-440 volt, tag #X81

BOTTOM BOARDS, TRANSITE
3 "Detroit" Hoists, 1 ton cap., 1 hp motor, type M (DC)
5 "Detroit" Hoists, 2 ton cap., 2½ hp motor, type M (DC)
1 "Detroit" Hoists, 4 ton cap., 7½ hp motor, type LHR (DC)
5 "Chicago Pneumatic" air hoists—2 ton cap., model A reversing eccentric
1 "Graham" variable speed transmission, model 60M, type 101386, serial #15669, tag #X55

12 200 lb. capacity magnesium melting pots
Approx. 100 ft. 20" conveyor belt, new
Approx. 100 ft. 14" canvas belt, used

BOHN ALUMINUM & BRASS CORP.
1400 LAFAYETTE BLDG.
DETROIT 26, MICH.

YOUR CLASSIFIED ADVERTISEMENT IN THE FOUNDRY BRINGS RESULTS!

IF YOU ARE SEEKING A CHANGE OF POSITION TO BETTER YOUR SITUATION AND ARE QUALIFIED FOR A BETTER JOB, TELL THE 35,000 READERS OF THE FOUNDRY ABOUT IT.

DON'T "HIDE YOUR LIGHT UNDER A BUSHEL"—THERE ARE TIMES WHEN A MAN SHOULD TALK ABOUT HIMSELF AND THERE ARE A LOT OF MEN QUALIFIED FOR BETTER POSITIONS WHO DO NOT KNOW HOW TO GO ABOUT IT OR WHERE TO SEEK HIGHER RESPONSIBILITIES.

YOUR CLASSIFIED ADVERTISEMENT IN THE FOUNDRY WILL BE WIDELY READ AND THE RESULTS MAY SURPRISE YOU!

IT COSTS BUT LITTLE. WHY NOT RUN AN ADVERTISEMENT ABOUT YOURSELF IN TWO OR THREE ISSUES?

WRITE
THE FOUNDRY
CLASSIFIED ADVERTISING DEPT.
PENTON BLDG., CLEVELAND 13, OHIO

Manufacturers' Agents!

REGISTER NOW WITH
—THE FOUNDRY—

• If you are interested in adding to the lines of foundry equipment, accessories or supplies you are now handling, please fill out the form below, or write us fully, stating what foundry equipment you are now handling and what allied lines you can take on.

We often have calls for available representation in various parts of the country and might be able to refer you to manufacturers with whom you can make a mutually profitable arrangement.

In the near future a new and revised Foundry Supply House and Manufacturers' Representative list will be published by us for use by manufacturers seeking additional sales representation and if you are in position to offer good coverage in certain areas, tell us about it and we will not only add your name to this new list but will keep the information on special file so that we may bring your facilities to the attention of those inquiring.

FILL OUT THIS FORM AND SEND IT TO US NOW

THE FOUNDRY, Advertising Department
Penton Building, Cleveland 13, Ohio

Date .....

Equipment or products we are now handling .....

.....

We would be interested in handling the following lines: .....

.....

Territory we now cover regularly: .....

..... Number of salesmen we employ: .....

We would appreciate being included in your new list and referring us to any manufacturers of the above equipment or producers of supplies who are seeking additional representatives.

NAME: _____

ADDRESS: _____

CITY: _____ ZONE: _____ STATE: _____

You want to be in the picture when the buying decision is made.

Your salesmen can't always see all of the men in a foundry who have a YES or NO vote. But your advertising in FOUNDRY reaches 45,000 of these men in every worthwhile foundry in the U.S.A. and Canada.

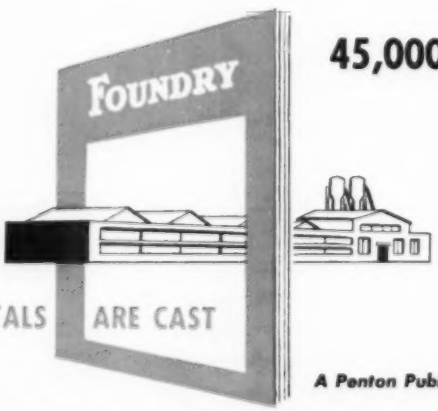
No other publication reaches so many foundries or enjoys so much cover-to-cover readership. No other publication exercises so great an influence upon the men who influence foundry buying.

Your advertising in FOUNDRY pre-sells them on your products—paves the way for your salesmen—and speeds up the necessary selling process.

FOUNDRY puts you in the picture when the buying decisions are being made. If you'd like to know what's in it for your company, just tell the FOUNDRY representative you want to see the file on Foundry Market Facts.

45,000 READERS

Helping You Sell To Foundrymen



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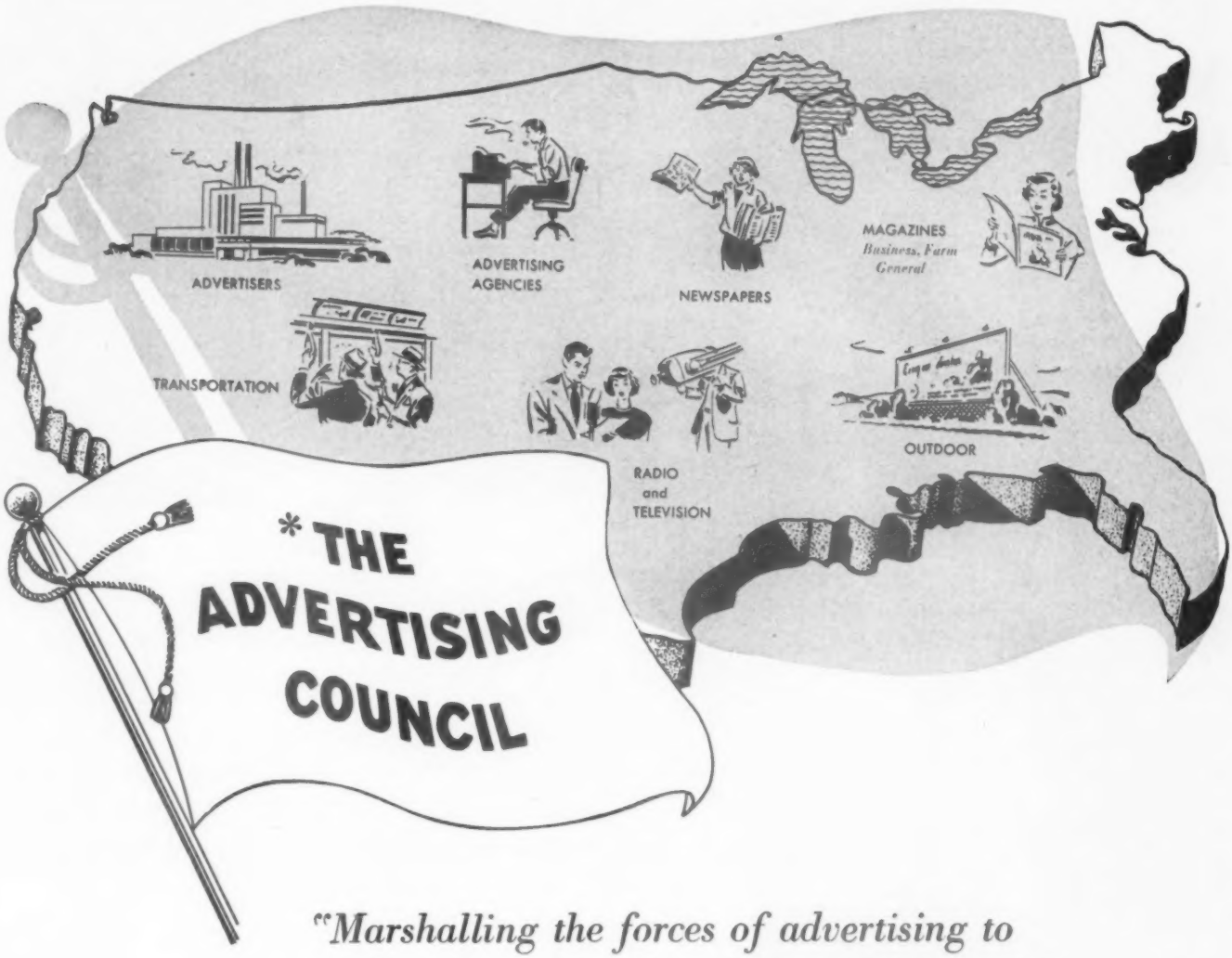

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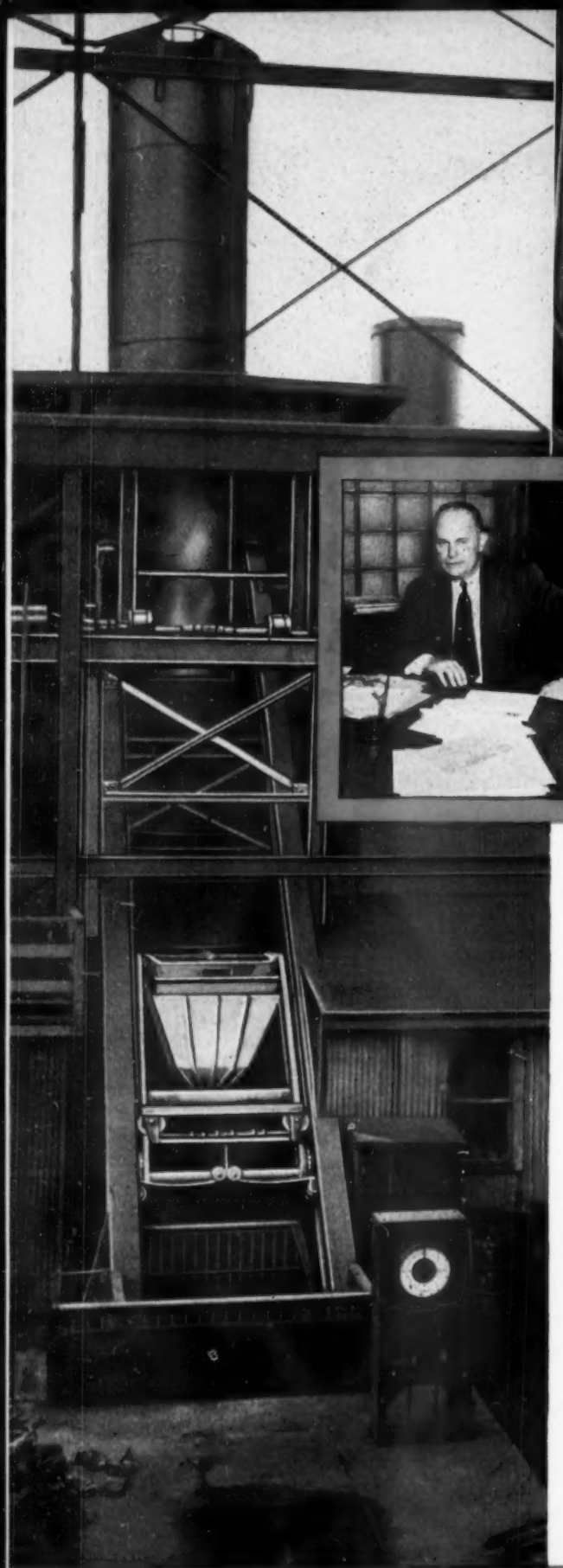

Mr. Wallace E. Thomas, President, Straight Line Foundry & Machine Corporation, Syracuse, reports hotter metal and lower melting costs.

ANOTHER FOUNDRY PRESIDENT
Reports on MODERNIZATION...

"charging our cupola by hand formerly required from seven to ten, full-time employees. With our MODERN charger we now use only three men — — a craneman . . . charger operator and a laborer."

President Thomas, at Straight Line Foundry & Machine Corporation, Syracuse also reports HOTTER METAL and LOWER MELTING COST! And hotter metal is sending more castings across the pay-scales. Largely responsible for both hotter metal and these timely savings in man-power is the MODERN, SMALL-CONE, SIDE-DISCHARGE bucket. As the four doors of the SMALL-CONE bucket swing open the coke, scrap and other components diffuse evenly over the full melting area of the cupola. Mr. Thomas explains the bucket's action in these words: **"a definite, uniform distribution along the periphery of the cupola permits our using a softer blast."**

The Straight Line installation and the SMALL-CONE bucket are good examples of the accomplishments brought about by MODERN engineers through their working TOGETHER with practical FOUNDRYMEN. For more information on this SMALL-CONE, wide diffusing action ask for new bulletin #147-AS: It's free to foundrymen who make request on their company stationery and write to Dept. F-12, MODERN EQUIPMENT COMPANY, PORT WASHINGTON, WISCONSIN.

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Whatever your foundry operations involve—you will find it will pay off in lower costs and greater production to consult Frederic B. Stevens, Inc. Your nearby Stevens representative will show you how our vast experience and technical facilities can quickly give you the right answer to any foundry problem—without obligation on your part. Yes, if it's anything for a foundry—from core wash to "know-how"—Stevens can deliver.

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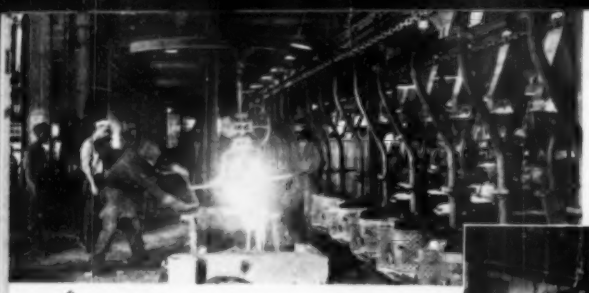
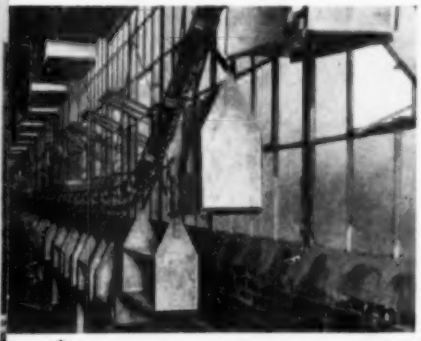


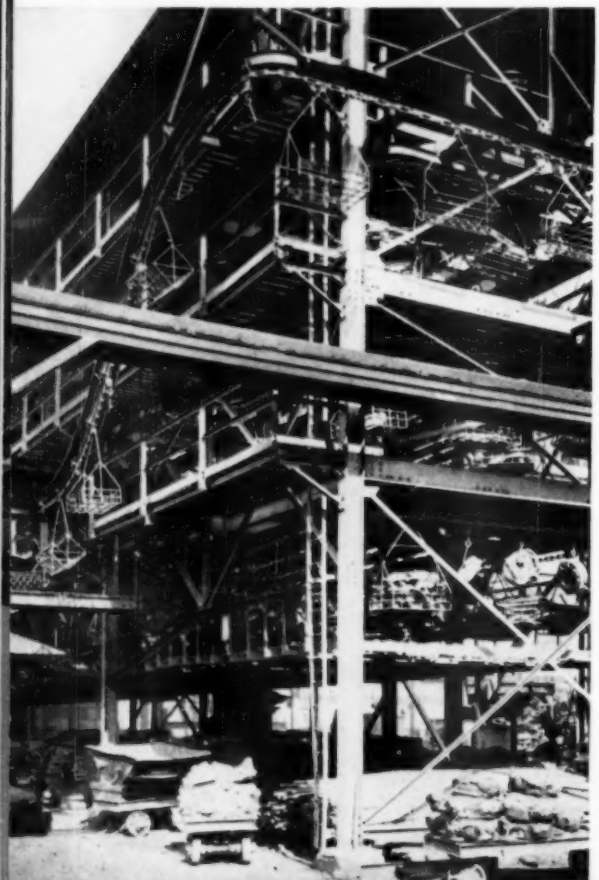
Link-Belt trolley conveyor for carrying the molds requires minimum space.



Core transport and storage conveyor.

Overhead trolley conveyor handling and automatically discharging sprue in charge-make-up area.

Cooling tower with overhead conveyor handling individual castings.



Casting from shakeout stations are handled in perforated buckets suspended from trolley conveyors.

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A Link-Belt trolley conveyor system is easily installed around existing equipment because the conveyor is supported from overhead—uses no floor space, in fact releases floor space for added production facilities. Any irregular path and the most suitable speed for the production requirements are employed. Little power is required to operate the conveyor and it is practically maintenance-free. In the pouring operation, larger ladles are handled—speeding the output with a saving in heat losses. Foundry production can be carried on at an even flow. And, with heavy lifting and carrying eliminated, working conditions are safer and better. All these advantages add up to appreciably lower costs.

Let Link-Belt experienced foundry engineers help you in applying a trolley conveyor system; also sand preparation and sand, mold, core and castings handling equipment. Ask our nearest office.

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FOUNDRY

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The Penton Publishing Company
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